

# INTERNAL/EXTERNAL OPERATIONAL ENVIRONMENT ASSESSMENT REPORT



STATE OF UTAH  
DEPARTMENT OF NATURAL RESOURCES  
Division of Wildlife Resources  
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Salt Lake City, Utah 84114

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# INTERNAL/EXTERNAL OPERATIONAL ENVIRONMENT ASSESSMENT REPORT

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# Internal Factors

## Internal/External Operational Environment Assessment Report

Utah Division of Wildlife Resources

# INTERNAL FACTORS

The Utah Division of Wildlife Resources (the Division or UDWR) is currently structured as a decentralized organization, with a Wildlife Board set up as the policy making body. This type of structure has administrative staff who act as architects while field personnel act as builders.

The Wildlife Board takes public comment and Division recommendations to direct policy on most aspects of wildlife management. It cannot however, supersede the administrative authority of the Department of Natural Resources' Executive Director or of the Division of Wildlife Resources' Director.

Administrative staff functions are performed within the Division primarily by employees in the Salt Lake office while line functions are performed by each of the five regions throughout the state (see chart). Administrative staff are responsible for developing and guiding specific wildlife related programs by: (1) developing policy for the Director; (2) standardizing management procedures; (3) providing plan and budget input; (4) evaluating program accomplishments that contribute toward objectives in the plan; (5) providing and updating essential databases; (6) reviewing data from the field for consistency and accuracy; (7) updating position descriptions, and (8) reviewing, summarizing and disseminating technical literature to the field. Through these tasks administrative staff guide the conduct of field personnel, without direct supervision over them.

Although the guidance for program function is overseen by administrative staff, field personnel are supervised in the region ultimately by a regional supervisor who is overseen by an assistant director. Duties of field personnel are set in annual work plan meetings, where administrative staff meet with each region to discuss plan objectives and priorities for each program. Field personnel then agree to accomplish certain tasks as outlined by the administrative staff. Administrative staff agree to provide the necessary resources for the field personnel to accomplish these duties.

The organizational chart on the next page shows the direct accountability of positions in both the administrative staff and the field portions of the Division. However, daily communication occurs between field personnel and administrative staff at lower levels of the organization to accomplish program goals and exchange information, even though there may not be any direct accountability between the field personnel and administrative staff. This interaction most commonly takes place on the coordinator (administrative) and manager (field) level.

If specific problems are encountered with the work being done by field personnel then the administrative staff must fall back to the accountability organization by contacting their immediate supervisor (usually the section chief) who would then contact the regional

## Organizational Structure

*continued*  
**Organizational Structure**

supervisor in order to rectify the situation. If the problem still cannot be resolved then the section chief may move up the organizational chart by contacting the assistant director who is both the section chief's supervisor and the supervisor of the regional supervisor to resolve the problem (see chart.) The assistant director would either make the decision if the staff are under his direct supervision or contact the director to resolve the problem. Consequently field personnel who have working problems with administrative personnel must fall back to the accountability structure in order to get the problem resolved. This process may seem cumbersome but is rarely needed to resolve issues, as most problems can be worked out before they proceed through the entire organizational accountability structure.

Prior to 1994 there was more direct accountability of field personnel to administrative staff. Budgets were directly controlled by administrative staff in charge of each program and there was more direct accountability between regional personnel and the section chiefs. The effect of budget control also increased the accountability of the regional personnel to the coordinators in charge of each program. In 1994, DWR director Bob Valentine empowered the field personnel by allowing the regional offices more control of their budgets and transferring all accountability of regional personnel to the regional supervisor, this led to the current organizational structure for the Division.

The culture of the Division of Wildlife Resources is a product of the history and tradition of the agency, the training and values of agency personnel and the concerns and expectations of the agency constituents.

The history and tradition of the agency spans almost one hundred fifty years. The first recorded effort to protect Utah's wildlife came in 1853 when the Legislative Assembly of the Territory of Utah passed an act to "...prevent the needless destruction of fish." In 1874, the Legislative Assembly broadened this protection to include "quail and wildfowl" and designated personnel "...to see that the provisions of this act are carried out." The first hunting seasons were established in 1876 and a position of Utah Territorial Commissioner was created in 1882.

Utah became a state in 1896 and the first Utah Legislature established a Committee of Fish and Game. The Committee reported that the territorial laws which were in force were fairly good, but constantly violated and recommended the creation of a Department of Fish and Game. The first State Fish and Game Warden, John Sharp, reported antelope, elk and mountain sheep were almost extinct and attempted to shorten hunting seasons on many species to protect them from overhunting by market hunters. During this same period, the deer season was closed for several years and sportsmen and ranchers purchased elk from the Jackson Hole and the northern Yellowstone herds to release onto Utah ranges. In addition to license requirements and season limits, Utahns experimented with a refuge system. Records indicate that the State Game Refuge Committee set aside almost one million acres of Utah's best deer and elk range as refuges to provide year-round protection for game animals.

As native game species declined, exotic species were introduced to replace them for both food and recreation. Several species of fish and game birds were introduced in this effort, including carp, rainbow and brown trout, pheasants and partridge. The first state fish hatchery opened in 1899. Early settlers often viewed predators as direct threats to their existence, both because of their direct take on livestock and their competition for game animals and several programs were developed to kill predators. These included bounties for many species, using poisoned baits, intensive trapping and hunting during all seasons of the year.

Wildlife management programs in practice today are largely the result of this early over exploitation. One of the products of the American Revolution was a strongly held belief that wildlife belonged to all people, not just those persons holding title to the land. This concept was endorsed by an early Supreme Court ruling which held that "wildlife was held in trust for all citizens by the federal government." The public ownership of wildlife and the

## Organizational History and Culture

### ***Wise Use Conservation Doctrine Theodore Roosevelt***

1. Outdoor resources constitute integral systems,
2. Conservation through wise use is a public responsibility,
3. Private resource ownership is a public trust and wildlife have rights even on private lands,
4. Science is the means of discharging the responsibility of wildlife and resource management.

*continued*  
**Organizational History and  
Culture**

public's trust responsibility for these resources led to: the elimination of commercialization of most wildlife, taxation for wildlife resources, recovery efforts for threatened and endangered species, and public involvement with wildlife through nongovernmental organizations such as the Audubon Society, The Wildlife Federation, Ducks Unlimited, Rocky Mountain Elk Foundation and Foundation for North American Wild Sheep.

In the early 1900s, President Theodore Roosevelt was instrumental in founding one of the first conservation initiatives, The Wise Use Conservation Doctrine. This doctrine was based on four elements;

- 1. Outdoor resources constitute integral systems,*
- 2. Conservation through wise use is a public responsibility,*
- 3. Private resource ownership is a public trust and wildlife have rights even on private lands,*
- 4. Science is the means of discharging the responsibility of wildlife and resource management.*

The wildlife management philosophy grounded in this doctrine was a belief that wildlife would last forever if it was harvested scientifically and not faster than it was being produced. Science was seen as the means of meeting the responsibility of wildlife management and this resulted in the emergence of the profession of wildlife management. The Fish and Wildlife Coordination Act of 1934 and the Federal Aid in Wildlife Restoration Act of 1937 (funding from user taxes on hunting equipment) solidified modern wildlife management, providing both the scientific information and the funding for the recovery of many of Utah's depleted wildlife (antelope, bison, deer, elk, turkey and waterfowl).

The legislative mandate for the Division of Wildlife Resources states: "The Division of Wildlife Resources may determine the facts relevant to the wildlife resources of this state." Although scientific resource management did not preclude public involvement, the emphasis on biological information tended to downplay social, economic and political factors. In fact, in establishing the policy for wildlife management, the Wildlife Board is charged to consider economic and social factors and private property rights. Regional Advisory Councils have been added to provide the public with more direct access to wildlife management direction.

The movement from a basically scientific resource management program to one which includes economic, various single-interest, and social values is one of the most difficult issues facing wildlife agency personnel today. The challenge is to define the biological and ecological limits for management alternatives and work with these various groups within that framework. This is not a simple task. Challenges to the biological and ecological systems may be unprecedented and the desires of interest groups are frequently disparate.

This section describes the process of fiscal analysis and budgeting in the Utah Division of Wildlife Resources. Fiscal analysis and budgeting are financial subsets of a planning and budgeting process that include planning, budgeting, execution and evaluation. The Division is somewhat unique in state government because of its income sources and the variety of those sources. For our purposes, fiscal analysis is the art of estimating forward income. Budgeting is requesting and allocating the legal appropriation of monies for Division expenditure.

### ***Fiscal Analysis and Income Sources***

The Division has the enervating task of spending monies in the same year they are received. The total budget for FY 1999 was \$37,870,797. The art of this process is making accurate but conservative estimates of income. Additionally, each income source may or may not have specific requirements for expenditure.

The major source of income is the sale of licenses and permits or user fees. The Division sells approximately one million documents per year that convey the legal right within specified requirements to hunt, fish or otherwise make use of the wildlife of the state (e.g., Habitat Authorization). Although sales income is somewhat predictable, actual income may vary due to economic conditions, perceived value, competing recreational choices, closures, or modifications to proclamations and even the weather. To further complicate matters, licenses and permits are sold on the calendar year and expenditures are made on the fiscal year (July 1 - June 30). Income from users' fees are not to be diverted to any use other than the direct benefit of wildlife. Although the expenditure of this income for uses other than consumptive (hunting and fishing) benefit is not prohibited, there has been some resistance to it based on the premise that those who pay should receive the benefit. This income is significant, approximately \$20.98 million for FY99 but does not support the Division's programs by itself.

Federal aid is perhaps the most difficult income source to understand. The US Fish and Wildlife Service (USFWS) is the trustee of an account of monies collected from a federal excise tax on the sale of hunting and fishing equipment and a portion of the federal gas tax attributable to the operation of boats. This process is governed by the Pittman-Robertson Act for hunting and the Dingle-

## **Fiscal Analysis and Budgeting**

### ***The budgeting process comprises the following steps:***

- 1) The Division prepares a budget consisting of revenues and expenditures following guidelines prepared by the Governor's Office and the DNR Executive Director.
- 2) The Division budget goes to the legislature as part of the Governor's budget after review and modification by the Department of Natural Resources Director and the Governor's Office of Planning and Budget.
- 3) The Legislative Fiscal Analyst provides a review of the budget to members of the Agriculture and Natural Resources Joint Budget Committee.
- 4) A day or two of hearings is allocated, wherein the Division director and financial manager make a presentation to the committee and answer any questions. The committee makes a recommendation on appropriation to the House and Senate. There may be further negotiation and modification by the legislative leadership. On the last day of the session, usually near the end of the day, the budget bill passes and becomes law. The appropriation is made on a line item basis. There may be "intent language" that spells out how certain monies may or may not be spent.

*It should be noted, MONEY NOT APPROPRIATED BY THE LEGISLATURE MAY NOT BE SPENT. It does not matter how much the Division may have in its account. The Division can only spend what has been appropriated. There is a further caveat for the Division, which is that the Division may not spend more than it has, even if it has been appropriated.*



*continued*  
**Fiscal Analysis and  
Budgeting**

Johnson and Wallop-Breaux Acts for fishing and motorboat access. The money is apportioned to each state generally based on land mass and licensed hunters/anglers.

This federal aid money is spent on “projects” in a 75% federal and 25% state split. A project must qualify for federal aid by showing direct benefit to consumptive use of wildlife. For example, any law enforcement work and endangered species work on behalf of non-sport species are not claimed. Federal aid is not released to the Division in a block grant but is claimed post expense. If a state does not bill to the level of apportionment within a two-year cycle, the leftover money is retained by the USFWS and is lost to the state. In FY99, these federal aid funds were \$7.21 million of the Division’s budget.

The Division is subject to a regular comprehensive audit by the US General Accounting Office to verify that federal aid funds are spent and documented according to regulations and that license and permit fees are not diverted to non-wildlife uses. Diversion of license fees to non-wildlife activities by a state can result in loss of federal funds.

The appropriation of general tax funds to the Division is termed “general fund money.” General funds are appropriated annually by the legislature. The Division has argued, with various levels of success, that wildlife is a significant value to the state and that those who don’t hunt and fish should financially support a resource from which they generally benefit. The general fund contributed about \$3.56 million to the budget for FY99.

Cooperative agreements can probably be described more familiarly as grants. Cooperators or grantors may be other state agencies, federal agencies, even private individuals, companies or foundations. Traditionally, this was a small portion of the annual budget, but with the inception of the Utah Reclamation and Mitigation Commission and its responsibility to mitigate for the impacts of the Central Utah Project, cooperative agreements have grown. The cooperator usually defines a project, the documentation required and the method and frequency of transfer of money. The Division complies with the agreement and accepts the money because it deems the project to be in the interest of wildlife. If the cooperator is a federal agency or receives federal funding for the project, the cooperative money cannot be used to match federal aid money, even though the project may otherwise qualify. As the fiscal year for federal agencies ends in October, year-end funds suddenly released for cooperative agreements must be merged into the ongoing Division budget as best as can be done. Nearly \$2.59 million of the FY99 Division budget came from cooperative agreements (\$1.938 Federal, \$654,000 Dedicated Credits).

*Contributed Research* funds reflect monies donated to the Division to perform work on specific species or projects. These funds amounted to \$361,000 in FY 99.

*Other revenues* included \$3.068 million of carry-forward funding from previous years and \$94,000 of dedicated credits from various sources.

There are other potential sources of income, including a proposed federal excise tax on birdseed, binoculars, film, etc. to support non-consumptive wildlife programs, and a portion of the Offshore Continental Shelf oil tax revenues. At the state level there is talk of a 1/8th of 1% sales tax to support wildlife diversity and open space/critical wildlife habitat protection, called the Utah Heritage Trust, a coalition of groups involving the League of Cities and Towns; The Nature Conservancy, Utah Chapter; and Sportsmen for Fish and Wildlife; as well as others.

What was referred to earlier as an “art” of fiscal analysis means to make a professional estimate of the income in each of these categories for the budget request year and provide that information available to management, keeping in mind that there is an analyst in the Governor’s Planning and Budget Office and an analyst in the Legislative Fiscal Auditor’s Office doing the same thing and with possibly different results.

### ***Expenditures***

The chart on the following page shows expenditures by classification (major accounting categories) and by program for the fiscal year ending June 30, 1999. Cost of personal services (i.e., employee salaries and benefits) amounts to slightly over half of the Division budget.

### ***Summary***

The Division has diverse and exacting funding sources and is part of a large entity that does business its own way. That way of doing business may change from administration to administration. For those preparing and implementing a management cycle that includes program-based planning, budgeting, execution and evaluation, there are challenges in incorporating funding sources and merging with an umbrella process.

## Technology, Facilities and Equipment

Often times, in an effort to ensure that the resource does not suffer, the Division of Wildlife Resources makes choices that fail to keep current with the dynamics of technology, facilities and equipment. This inclination is somewhat diminishing as we enter into the new century. Conscious efforts are being made to offer our employees training and opportunities in current technologies that will positively affect the resource, upgrading facilities that will better serve the public and providing state-of-the-art equipment that benefits the resource, the public and the employee.

### Technology

#### *Past (1985)*

- *Phone system - multiple lines passing through a switch-board occupied by one person.*
- *Computer system - WANG with WANG applications, limited to office technicians and some office managers. A few biologists had their own computers. There was a committee charged with defining the direction of data processing, but it fell short of realizing that goal.*
- *Radio communication - vehicle to vehicle with remote areas difficult to reach. Office contact was dispatch to vehicle, vehicle to dispatch to office.*
- *Telemetry - primitive.*
- *No FAX or telecopying machines.*
- *US Postal system - one, two, three day delivery depending upon location; postage stamps were used with little regard to weight of envelope, package, etc.*
- *Introduction of new register afforded more accurate reporting of sales. Monthly reporting of license and sales activity and transactions.*
- *Loose cash controls.*
- *FIRMS accounting system - limited access by employees - monthly reporting of budget/expenditure status.*

#### *Present (1999)*

- *Phone system - with the exceptions of CRO and NERO, phones are direct line access, voice mail, routing for assistance in the event of emergencies, etc.*
- *Computer system - central committee which authorizes purchases of hardware and software. Continuous upgrading of equipment and applications. Network applications that bring multitudes of opportunities into the workplace are accessible.*
- *E-Mail, Internet applications (of which we are sorely behind other departments within the state) etc.*
- *Radio communications - vehicle to vehicle. State-of-the-art transmission is enabling contact in remote regions of the state.*
- *Cellular telephones and pagers enable office to vehicle, office to anywhere contact of employees who are in possession of the equipment.*
- *Postage meters, scales, - more accurate use of postage dollars.*

- *Cash register receipting - daily reporting with daily transactions recorded in the state accounting (FINET) system.*
- *FINET accounting system - accessed by regions capable of reporting daily budget/expenditure status.*
- *Geographic Information Systems (GIS) - available and operational in the Salt Lake office, all regions, satellite offices throughout the state, but is lacking complete inventory data on the system. Currently all GIS data are available only upon request.*
- *Global Positioning System (GPS) and Laser equipment - used by only a few for data collection.*
- *Telemetry - use of more equipment that is more accommodating to the biologists' needs.*
- *Automated limited entry drawings, generation of preprinted applications, acceptance of Visa, MasterCard, Discover, and American Express credit and debit cards available for all requested services, generation and printing of requested permits and licenses, and transfer of refund information to FINET also now available.*
- *License information system is inventory based and linked to pertinent information systems through various storage methods and computer platforms.*

#### *Future (2002)*

- *Phone systems - state-of-the-art with all regions, satellite offices, etc. where possible using identical equipment and having identical services (direct line access, voice mail, call routing).*
- *Computer system - implementation of state-of-the-art wireless digital communications beginning with Conservation Officers' vehicles and sites with problematic land based lines, other sites could be upgraded when economically feasible. Keep current with all state agencies in the information technology arena.*
- *Customer oriented information system integrating the majority of collected customer information, allowing Internet and phone based ordering of licenses. Automated selling and printing of licenses/permits at DWR offices and sales agent remote sites (point of sale). Electronic transferring of funds from License Sales Agents. Secure Internet access to wildlife customer data for authorized personnel.*
- *Cash register receipting linked with regional office license point of sale, generating sales reports. Continued acceptance of credit/debit cards for goods and services.*
- *GIS - information available to all authorized employees.*
- *State-of-the-art information collection devices employed by all appropriate employees, including but not limited to, Global Positioning Satellite (GPS) system, laser equipment, and digital cameras.*

#### **Facilities (p.11)**

##### *Past (1985)*

- *Salt Lake Office - old building; not compatible with ADA*

*continued*  
**Technology, Facilities and  
Equipment**

*requirements, employee nor public needs. Definitely a wildlife friendly environment with a tremendous comfort zone for customers and employees.*

- *Five Region Offices -*  
**NRO** sole use facility remodeled to accommodate changing office environment, destined to be too small within a short time frame.  
**NERO** located as a department shared building with open office concept, use of modules, travel to equipment storage.  
**CRO** sole use facility newly remodeled by adding second floor. Use of adjacent facilities allows for growth.  
**SRO** sole use building with new carpet covering the structurally insecure floor. Sure to be condemned.  
**SERO** sole use building that was old when acquired by DWR. New addition extends future controlled growth.
- *Satellite facilities located in Northern, Southern and Southeastern Regions.*
- *Hatcheries 10 - Kamas, Fountain Green, Whiterocks, Midway, Springville, Loa, Mantua, Egan, Mammoth Creek and Glenwood.*
- *Waterfowl management Areas, Wildlife Management Areas, cabins, all in varying degrees of use and all in need of constant maintenance.*

*Present (1999)*

- *Salt Lake Office - DWR is located in the DNR complex second floor with the front counter located on the first floor for **One Stop Shopping**. The facility is 3-years old and is an up-to-date facility.*
- *Five Regional Offices -*  
**NRO** - Sole use of the facility, will need to be remodeled to accommodate growth and new assignments in the Northern region.  
**NERO** - Shared space with other state agencies. Space is well used, but needs to expand. A storage yard is located three miles from office.  
**CRO** - Sole use facility. Facility will need to be remolded to accommodate future needs. Front lobby area will need to be enlarged and offices will need to be added.  
**SRO** - Old building has been condemned and torn down. New SRO location is in the UDOT complex where DWR and UDOT share space. The facility does not provide room for growth or lobby area. The storage yard is located two miles away.  
**SERO** - Moved to the new Human Services building. This is an interim stay for five years. A Department complex is in the planning stage. Old office facility will possibly be used for hunter education in the region.
- *Satellite facilities located in Northern, Southern, Northeastern, Southeastern and Central regions.*
- *Of the ten hatcheries, a new Kamas hatchery is being constructed, Fountain Green is in the design phase, and*

*Whiterock's hatchery is listed to be built in the next five years. Paid for in part by an increase in fishing license fees.*

- *Waterfowl Management Areas, Wildlife Management Areas and cabins throughout the State.*

*Future (2005)*

- *NRO: Renovation and addition that will adequately serve the public and employees.*
- *CRO: Repair and maintenance as needed.*
- *SRO: Housed in a facility that adequately meets the needs of the Division.*
- *SERO: Housed in a department complex with adequate equipment storage area.*
- *All satellite facilities, hatcheries, cabins, etc. will have a routine maintenance program with adequate funding.*

**Equipment**

*Past (1985)*

- *Smith & Wesson 9mm guns - law enforcement.*
- *c. 1970 house trailers*
- *c. 1970 horse trailers*
- *c. 1970 boats (including air boats)*
- *c. 1970 snowmobiles*
- *c. 1970 OHVs*
- *c. 1960 farming equipment*

*Present (1999)*

- *Glock guns - law enforcement*
- *1970 equipment slowly being replaced with new equipment. Trailers (house and horse), snowmobiles, OHVs, boats, etc.*
- *Some habitat equipment is being purchased on habitat projects, however, the old farming equipment is being used when not in for repairs.*

*Future (2005)*

- *Depreciation/replacement scheduling of all equipment based on use and engine hours.*
- *State-of-the-art or cutting edge equipment that keeps pace with that used by our publics.*

**Major Facilities**

Offices	Salt Lake Office Northern Region-Ogden Central Region-Springville Northeastern-Vernal Southeastern-Price Southern-Cedar City	
Hatcheries	Kamas Whiterocks Springville Mantua Mammoth Creek	Fountain Green Midway Loa Egan Glenwood
Other	Lee Kay Center Hardware Ranch Cache Valley Hunter Education Center	

## Habitat Fund

In recognition of the growing concern for habitat loss and the need to preserve and enhance access for wildlife purposes, legislation was passed in 1995 authorizing the Division of Wildlife Resources to establish a Wildlife Habitat Authorization program. This legislation requires hunters, anglers, trappers and Heritage Certificate holders, to purchase a Habitat Authorization annually, prior to purchasing any license or permit. The legislation further established an account for those monies and directed that the funds could only be used for the purposes of enhancing, preserving, managing, acquiring or protecting fish and wildlife habitat and for improving public access for fishing and hunting, and further directing that any unused funding would remain in the account and would not lapse into other state funds. Prior to this legislation, the Division had two provisions in law that provided for habitat and access. Waterfowl hunters were required to purchase a \$3.30 State Duck Stamp and upland game hunters had to purchase a \$5.00 Upland Game Stamp. These provisions, however, did not provide for angler and big game hunter concerns. Both of these stamps were rescinded with the new legislation. The new legislation contained language that requires the Division to maintain habitat-related expenditures to amounts approximately equal to the revenues they were receiving under the Stamp programs.

Another important component of the legislation was recognition of the Division-established Habitat Council as a key entity in the decisions on how to spend the funds. The eight-member Habitat Council is advisory to the Director and is comprised of four citizens representing differing wildlife concerns and three Division Program Chiefs (i.e., Habitat, Aquatics and Wildlife), plus the DWR Federal Aid Coordinator. This Council representation provides sportsmen with the opportunity to influence the expenditure of the funds. Careful attention is given toward expenditure of the funds in the same proportion to which they are collected from the license groups (i.e., fishing, big game, upland game, waterfowl).

The fund generates approximately 2.25 million dollars each year. Approximate expenditures for projects in 1999 were: aquatic projects - \$982,000, big game projects - \$766,000, upland game projects - \$489,000, waterfowl projects - \$287,000, and native species projects - \$42,000. Most approved projects are cooperatively funded by sportsmen groups or other agencies, and allows DWR to do many more projects than otherwise possible.

One project that was realized in FY-97 was an agreement with the School and Institutional Lands Agency which preserves wildlife user access to 3.7 million acres. The agreement is for ten years and may not have been possible without these funds.

In 1997 an additional twenty-five cent fee was attached by the legislature to cover search and rescue costs incurred by state and local jurisdictions. In the 1998 Legislative session the Habitat Authorization fee, including the search and rescue surcharge was raised to six dollars, making the wildlife portion \$5.75.

The 2000 Utah Legislature, through Senate Bill 248, eliminated the Habitat Authorization (effective January 1, 2001). However, the Habitat Account as administered by the Habitat Council, was kept intact. When this bill takes effect, an additional fee will be tacked on to each license and permit to cover the contribution to the Habitat Account. The bill also allows those who wish to donate to contribute directly to the Habitat Account. Use of these donated funds by the Habitat Council is not restricted by the limit set by the legislative appropriation on the funds generated through license and permit sales. It is still anticipated that approximately \$2.2 million will be available annually for reinvesting in wildlife habitat needs as a result of this additional license/permit surcharge. An indirect outcome of the process within this new bill enables license agents to receive a slightly larger commission from the handling and sale of DWR licenses and permits. Furthermore, a relatively small amount of additional restricted dollars will be freed up for DWR program application.



## Partnerships in Wildlife Management

Natural biological systems are generally very complicated and relatively slow to change.

Observed changes may be the culmination of numerous seemingly unrelated events that have occurred over a number of years. Many natural systems that produce high quality habitat for a specific animal or fish have not been studied in detail. The art and science of wildlife management is relatively new and rapidly advancing.

Several agencies and organizations have a direct and vested interest in wildlife populations and wildlife habitats. Agencies such as the US Forest Service, the Bureau of Land Management, and the US Fish and Wildlife Service have responsibility for wildlife and/or wildlife habitats. Universities and colleges generally have departments that deal with various aspects of resource management. Numerous non-government organizations deal with wildlife and their habitats.

All of these groups employ biologists, purchase equipment, conduct studies, provide public education, and engage in other activities in common with each other. There are many opportunities for duplication of efforts.

The Division of Wildlife Resources has, over the years, entered into numerous long term cooperative agreements with agencies and organizations for the purposes of conducting long-term research, achieving common management goals, aiding in the dissemination and acquisition of information and specific expertise, and minimizing duplication of efforts. In general these agreements have been highly successful and productive. Examples of successful cooperative agreements and programs follow.

### **Western Association of Fish and Wildlife Agencies (WAFWA)**

Organized in Salt Lake City in the early 1930s and active since that time. WAFWA is affiliated with the International Association of Fish and Wildlife Agencies. WAFWA meets twice yearly and serves as a forum for information transfer, discussion of common issues, sharing of expertise, etc. Wildlife commission and board members, state directors, and program chiefs meet at association meetings. Utah will be the host state for both the midwinter (San Diego, CA) and summer (Park City, UT) meetings in January and July 2001, respectively.

### **Great Basin Research Center (Ephraim) and Forest Service Shrub and Science Lab (Provo)**

Both of these important programs are part of a continuing cooperative agreement between the US Forest Service and DWR. The agreement has been functioning since the early 1950s and continues to this day. DWR and the Forest Service share the need for:

- plant materials to use on rangeland,
- techniques for rehabilitating depleted rangelands, and
- information on the condition and trend of rangelands.

These cooperative programs have served the agencies' needs well and serve as a model for other states.

### **Book Cliffs Conservation Initiative**

The Book Cliffs Conservation Initiative was organized as a cooperative program by DWR, the Bureau of Land Management, The Nature Conservancy, and the Rocky Mountain Elk Foundation as a means to provide for improved multiple-use management in the Book Cliffs with increased emphasis on wildlife and public access. The initiative is recognized nationally as an effective effort to manage public resources more effectively and efficiently.

### **Utah Big Game Range Inventory**

In June of 1958, the Utah Department of Fish and Game (now Utah Division of Wildlife Resources) initiated a long term program to inventory deer winter ranges throughout Utah.

Since winter range is the limiting factor for most game populations in Utah, it is important to know the extent, condition and long-term trend of winter ranges. The Range Inventory Program continues today as a cooperative program with the US Forest Service, the Bureau of Land Management, and the Utah Department of Agriculture and Foods. This program is unique in the west because it provides the only long-term trend data for many Utah ranges.

### **Utah State University Cooperative Wildlife Research Unit**

The primary mission of the Unit is to address food web and habitat related problems relating to the fishery and wildlife resource in Utah and the Inter-mountain West. In addition to the more traditional fields of biological endeavor, expertise in geographical information systems, expert systems, artificial intelligence, sociological science, survey methodology, chemical and contaminant analysis, and computer modeling and methodology, as well as other pertinent fields, are brought to bear on resource problems. The primary motivation of the Unit is to solve pressing resource problems. Research activities focus on landscape-level habitat studies, ecological modeling of lake, reservoir, and riparian systems, and avian and terrestrial ecology. Future research directions of the Unit will continue to involve endangered fish and wildlife species, terrestrial and aquatic riparian studies, migratory non-game bird research, and geographical information system methodology, and landscape-level studies.

The above list is far from complete but it serves to demonstrate the need for and value of long-term cooperative agreements involving the Division. Through the years, and especially in recent years, the DWR has entered into numerous kinds of agreements with agencies and governments as well as many individuals and clubs. The Dedicated Hunter Program and the Adopt-a-Stream Program are examples of the trend toward getting individuals involved in on-the-ground activities to benefit wildlife. As the human population in Utah increases, wildlife issues will tend to become more complex and more difficult. The current trend towards decreased gov-

*continued*  
**Partnerships in Wildlife  
Management**

ernment at all levels makes cooperation not only advantageous, but almost mandatory.

Cooperative agreements and partnerships offer tangible benefits when dealing with complex issues and allow for more efficient use of government resources as well as better management of wildlife resources.

The Central Utah Project (CUP), is a specific, highly complex federal water development effort begun in 1956. CUP was conceived to divert water from the western Uinta Basin to population centers along the Wasatch Front, for irrigation, municipal, and industrial uses.

Congress initiated CUP with passage of the Colorado River Storage Project (CRSP) Act of 1956, in which CUP was the largest participating project. Congress subsequently amended language or increased the authorized appropriations ceiling for CRSP several times, and until the early 1990s, the US Bureau of Reclamation (USBR) led federal implementation of CUP.

When it became clear that another increase in the authorized appropriations ceiling would be needed to complete CUP, the Utah Division of Wildlife Resources, among many others, became actively involved in shaping federal legislation to provide maximum benefits for Utah.

CUP was thoroughly redefined with passage of Public Law 102-575, the Central Utah Project Completion Act (CUPCA). CUPCA Titles II-IV contain the key provisions for wildlife and the DWR. More than any prior federal law, CUPCA defines CUP both now and in the future. CUPCA provides for the orderly completion of CUP and other features by authorizing an increase in the appropriations ceiling for construction of certain project elements (generally consisting of water storage or conveyance features, and in a few cases, water conservation plans or studies), and for the planning and implementation of substantial mitigation and conservation measures associated with fish, wildlife, and outdoor recreation lost through federal water development in Utah.

Title II of CUPCA focuses on construction of incomplete projects to store, convey, or conserve water; these projects would be accomplished primarily by the Central Utah Water Conservancy District (CUWCD) and USBR. Notable examples of Title II projects are the Irrigation and Drainage System (which has undergone significant modification since CUPCA's inception), the Wasatch County Water Efficiency Project, and the Uinta Basin Replacement Project (UBRP; comprised of the Upalco and Uintah Units). DWR has for several years assigned a liaison coordinator to work in the CUWCD's Orem office, to facilitate DWR involvement in developing mitigation strategies for Title II construction projects.

Title III provides for establishment of the Utah Reclamation Mitigation and Conservation Commission (URMCC) to coordinate implementation of CUPCA-related mitigation and conservation measures by the appropriate federal and state fish, wildlife, and outdoor recreation agencies. URMCC also possesses broad discretionary authority to make policy, determine mitigation and conservation priorities and administer funding in accordance with a five-year *Mitigation and Conservation Plan (Plan)*.

## Central Utah Project (CUP)

*continued*  
**Central Utah Project**

Following significant public involvement, the first *Plan* was issued in 1996. Mitigation and conservation priorities were updated in the 1997, 1998, and 1999 *Plans*. Similar updates are expected in subsequent years, with a more sweeping revisions scheduled every fifth year.

Title III of CUPCA also lists specific mitigation and conservation measures which reflected the intent of Congress at signing, but which by design may be (and have been) modified by URMCC, following public and agency input, to better address current conservation needs. The *Plan* is essential to understanding how Title III will be implemented because it specifies current program priorities and funding levels, then translates them into specific implementation strategies. This title authorizes appropriations in excess of \$145 million (variously indexed in early 1990s dollars). DWR has participated in many of the Title III projects begun since 1992.

In Title IV, Congress found that environmental mitigation for the development of CRSP was “seriously in arrears.” They also determined that mitigation for such a large trans-basin water diversion project was challenging because of inherent complexity, but also highly important given the ecological value of important natural areas in Utah. Congress further recognized that considerable mitigation challenges would persist long after the project features of CRSP were constructed.

Accordingly, Title IV established the Utah Reclamation Mitigation and Conservation Account (Account), designed to provide on-going support for:

- (a) maintenance of the level of mitigation and conservation achieved in Utah by CUPCA or CRSP features*
- (b) management and maintenance of investments in fish, wildlife, and recreation features identified in CUPCA or CRSP in Utah*
- (c) mitigation of known environmental impacts stemming from CUPCA or CRSP in Utah, where no funds have been earmarked*
- (d) unknown environmental needs or opportunities in areas of the State affected by CUPCA or CRSP*

The Account is an interest-bearing U.S. Treasury account into which, during each of the Federal fiscal years 1994-2001, the State of Utah voluntarily contributes \$3,000,000, the Federal government contributes \$5,000,000, and CUWCD contributes \$750,000 in non-Federal funds. Upon completion of the projects and features identified in Section 315 of CUPCA, the interest accrued in the Account may be expended by URMCC until the Mitigation Commission terminates. At that point the interest income would be administered by the DWR. No part of the principal may be expended for any purpose.

Since inception of CUPCA, all contributions to the Account have been made as planned. Assuming all deposits occur as scheduled through fiscal year 2001, the state will ultimately benefit from an estimated (indexed) \$11-13 million annually in non-lapsing pay-outs, consisting of account interest earmarked for mitigation and conservation purposes cited above.

The five-member Commission, after taking office in 1994, soon began assembling the staff needed to address the significant technical and administrative demands inherent in managing a multi-million dollar annual budget. The present staff are skilled, experienced employees drawn largely from other natural resource agencies or similar professional environments. The great majority of DWR's interaction with URMCC occurs through staff-level contact.

In any analysis of CUP today, the *Plan* should be considered a controlling "first filter" of potential mitigation and conservation projects under CUPCA. Worthwhile mitigation and conservation concepts must first make it into the *Plan*; only then may they be funded under authority of the Mitigation Commission and Title III of CUPCA. The annual planning window, the period during which the Mitigation Commission accepts new proposals for comprehensive evaluation and ranking, has typically opened early in January of each year, with an updated *Plan* issued in early April of the same year.

Title III activities will not be completed by 2001 as originally scheduled due to reductions in annual appropriations and unavoidable delays in launching several complex mitigation or conservation efforts. The primary relevance of this delay, beyond delayed receipt of Title III project benefits, is that Account funds will not become available until completion of the projects and features scheduled in Section 315 of CUPCA.

As discussed above, the precise date of Title IV funding availability cannot be predicted accurately. These funds will be both substantial and relatively stable from year-to-year. DWR should prepare for their availability. Until they become available, federal funding for operations and maintenance (O&M) could be limited.

Two of the key questions which will need to be eventually answered are: (a) what proportion of the Account will be or should be made available for "O&M" as opposed to new mitigation and conservation efforts and (b) what kinds of costs (e.g., personnel services vs. current expense), if any, would qualify for O&M funding from the Account. For the 20 years following the end of the federal fiscal year during which the Secretary of the Interior declares CUP to be substantially complete, at which point the Mitigation Commission will expire, the Mitigation Commission will determine how Account funds are spent.

Several interesting things will happen according to CUPCA when the Mitigation Commission expires 30 or so years from now. To

*continued*  
**Central Utah Project**

begin with, DWR will take on the duties and authority of the Mitigation Commission, including the authority to expend interest earnings from the Account. The account (non-contributory by this time) will persist indefinitely, possibly forever. Title to any real and personal properties then held by the Mitigation Commission will be transferred to the appropriate division within the Utah Department of Natural Resources, or in the case of real property occurring within federal land ownerships, to the appropriate federal agency.

The URMCC, on behalf of the United States, will likely acquire a significant amount of federal land during the implementation phase of Title III. The general view held by federal cooperators is that the federal government will acquire the lands necessary to achieve the mitigation and conservation purposes of CUPCA, fund the initial developments necessary to secure the required mitigation or conservation benefits, then - and this is important - they will transfer title to the state (or other entities) who would then become wholly responsible for funding O&M of such mitigation lands, at least until Title IV funds become available and are allocated for such purposes, if they ever are.

This financial responsibility should be considered substantial and open-ended. DWR must fairly soon decide (a) whether it agrees to accept this responsibility, and (b) where DWR would find the requisite funds, should it agree to such an arrangement.

Intensive recreational demands will be placed on these mitigation lands, and DWR will need to decide how to address recreation impacts. Particularly in the case of linear (riverine) wildlife management corridors, DWR will face management situations which may not have been addressed completely in the past. For example, what protocol will we follow to determine when resource protection problems require trash receptacles, toilets, hardened trails or parking areas, or any of a hundred other potential management measures? What level of public demand might cause us to consider developing certain areas for increased public recreational use? Essentially, DWR must define the role it needs to play to protect the resource, and then what role it could or should play to better serve the demands of the recreating public. It is clear that an increasing human population will place increasing recreational demands on publicly owned wildlands and riverways, regardless of how they come into public ownership.

Funding partnerships (defined here as strategic offerings of state funds or in-lieu contributions which supplement Mitigation Commission efforts) may become more important in determining which mitigation and conservation measures move forward. The concept of DWR becoming more active in influencing Title III implementation clearly deserves a thorough internal debate. By strategically targeting desired program outcomes and programming funds to supplement and thereby influence federal mitigation priorities, DWR could undoubtedly carve out a more effective role in

determining how Title III develops. We have already done this successfully in the case of CUP fish hatchery construction.

Title III mitigation and conservation efforts have been viewed by some as solely a federal responsibility which the federal government alone should fund. While there is certainly logic to that argument, DWR needs to decide whether its interests are best served by leaving it all to the federal agencies. Whether broader application of this strategic tool is good for DWR on the whole remains to be determined. The relative benefits of supplementing a particular URMCC project with state funds and/or other contributions should be assessed and compared to the benefits of allowing those resources to continue to remain within existing program budgets.

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*\*The Mitigation Commission consists of 5 Utah residents appointed by the President of the United States, as follows: a person qualified in fish and wildlife matters, as recommended by Utah's U.S. representatives; a person qualified in fish and wildlife matters, as recommended by Utah's U.S. senators; an employee of the Utah Division of Wildlife Resources; a person recommended by the Central Utah Water Conservancy District; a person qualified in fish and wildlife matters, as recommended by Utah's nonprofit sportsmen's or environmental organizations.*



## Depredation Management

Big game animals, predominantly mule deer, elk and pronghorn antelope, often utilize agricultural crops and stored feeds where these animals occur in close proximity to Utah's developed areas. This activity is commonly referred to as agricultural depredation. Depredation also occurs when domestic livestock are killed in areas commonly shared with large predators such as coyote, cougar and black bear.

Solidly based on Utah law, the Division of Wildlife Resources addresses the impacts of depredation by means of prevention and compensation. An array of preventive measures are employed by the Division including herding, fences, diversion crops, killing animals by agency personnel and public hunting. Depredation prevention and/or response to landowner complaints is accomplished by

five regional offices and the Salt Lake Office personnel. Regional Wildlife Managers and their biologists and technicians perform the majority of depredation work. They are also assisted by Conservation Officers and other personnel as assigned, depending on the region's work plans.

While no comprehensive record of total costs and time expended have been specifically identified toward the annual efforts, a reliable estimate of costs in the early 1990s was \$750,000 to \$850,000 including materials and funds paid for crops lost to animals. Payments at that time were limited to a maximum of \$2,000 per landowner annually.

Compensation payments are now unlimited, meaning any one landowner may claim any amount of legitimate damage. Ultimately, though, the total amount paid annually is limited to a maximum of \$500,000 unless carryover funds are used in excess of this amount. Annually the Utah legislature budgets \$250,000 from general tax funds and the Division is responsible for providing an equal amount from its restricted account. If damage claims exceed the annual funds on hand, payments to landowners are prorated at the end of the fiscal year. In the 1995-96 year, these costs amounted to \$340,000.

Compensation may occur through monetary payment or by issuing mitigation permits to farmers and ranchers who have incurred damages or loss of crops or livestock. In specific instances, the farmer or rancher may legally kill animals in order to protect crops.

During fiscal year 1997-98, nearly 300 landowners were reimbursed for damages caused by big game animals and over 120 landowners received permanent fencing materials for damage prevention. Together, expenses amounted to \$499,000. Compensation for losses caused by predators typically amounts to the \$50,000

**Table 1. Wildlife Section Expenditures on Big Game Damage Payments and Fencing**

FY 99 Season	
FY 99 TOTAL:	\$402,000.00
Fencing Costs:	\$206,943.00
Claims:	
over \$500.00:	\$140,204.00
\$500.00 and under:	\$20,589.00
Temporary Employee Wages/Benefits:	\$34, 264.00
<b>Total Big Game Damage Payments and Fencing Expenditures</b>	
By Year: FY 1995 - FY 1999	
FY 99	\$402,000.00
FY 98	\$499,448.00
FY 97	\$470,183.00
FY 96	\$371,823.00
FY 95	\$287,928.00

**Livestock Depredation Occurrence and Payments in Utah, 1995 - 1999**

	Confirmed Losses			Amount Paid		
	Bear	Cougar	Total	Bear	Cougar	Total
FY 99	577	730	1,318	\$46,579	\$52,964	\$100,261
FY 98	519	805	1,324	\$41,762	\$58,233	\$99,995
FY 97	493	937	1,471	\$16,670	\$33,332	\$50,002
FY 96	290	878	1,097	\$12,415	\$37,589	\$50,004
FY 95	459	1,130	1,525	\$14,160	\$36,278	\$50,438

The percent compensation by confirmed kills over this time frame have varied from as low as 30.4% in 1997 to 59.6% in 1998; this percentage was 56.9% in 1999.

allocated for this effort annually. In 1997-98, however, losses nearly doubled to virtually \$100,000, due to the loss of twice as many calves.

Damages caused by big game animals are also recognized by law on native rangelands, not just agricultural crops. Compensation for use of private ranges by big game species occurs through issuing “mitigation” permits to the landowner who may assign an antlerless deer permit, for example, to a hunter who then pays the landowner a trespass fee. The hunter harvests and hence removes the offending animal from the rangeland in question. In 1998, 1,491 of these depredation/mitigation permits were issued in the state from July through October 17<sup>th</sup>, inclusive. In 1999, 1,998 of these depredation/mitigation permits were issued in the state from July through October 10<sup>th</sup>, inclusive.

The Division’s annual depredation effort is substantial in terms of personnel time. No effort has been made to identify how much time is devoted to crop depredation. However, the time is significant, probably amounting to 35 to 50 percent of a biologist’s time annually. Personnel must divert time and attention which could otherwise be devoted to other important management challenges. Other kinds of costs, including scare devices, specialized fencing, capture efforts, as well as the reduction in animal resources, is of significance to the Division and the public.

But there is a positive side to depredation efforts too. Affected farmers and ranchers are compensated for their losses as fairly as is possible and significant recreational hunting beyond traditional hunting opportunities is realized.

# External Factors

## Internal/External Operational Environment Assessment Report

Utah Division of Wildlife Resources

# EXTERNAL FACTORS

Utah has approximately 700 species of vertebrate wildlife that have been known to occur in the state within historical time - meaning the mid 1800s, and thousands of species of invertebrates. This discussion addresses vertebrate species. This total included: 68 fish; 18 amphibians; 54 reptiles; 423 birds; and 136 mammals. This total includes species that are now extinct, extirpated, accidental and exotic, or introduced species, such as the carp, house sparrow, European starling, brown trout, burro, and ring-necked pheasant.

Rock art left by early inhabitants of Utah, such as the Pueblo and Fremont Indians, may indicate the presence of some species in the area. Of 193 rock art locations inventoried, the bighorn is depicted at 134 in both desert and mountainous areas, possibly representing both desert and Rocky Mountain bighorn sheep. Deer are found at 59 locations, snakes at 58, bison at 19, bear at 11, elk at 7, pronghorn at 6, lizards at 4, cougar at 2 and birds at 18. Other wildlife possibly depicted include moose, mammoth, turkey, bobcat, rabbit, wolf, badger, weasel, turtle and grouse.

An exhaustive list of the number of wildlife species present when European man began to settle the state is not available. However, from written observations of early explorers, such as Peter Skene Ogden, William Ashley, William Clayton and John C. Fremont, some understanding of the wildlife community at that time is possible.

Bison, bighorn sheep, pronghorn, wolverine, beaver, river otters, grizzly bears, and wolves are species that were prevalent in early written histories (Rawley 1985). In the early to mid nineteenth century, native grasses, such as blue bunch wheatgrass and Great Basin wildrye, dominated valley benches and bottomlands. Aspen was much more abundant, and conifer stands less common. Pinyon-juniper woodlands were less extensive, covered by native grass/sagebrush parks. Indian ricegrass, needle and thread grass, and winterfat covered desert ranges. Wet meadows and willow bottoms were found along stream courses, which have been replaced by gullies surrounded by rabbitbrush and greasewood (Cottam 1947). These vegetative communities supported a wildlife community that differs from that found in Utah in 2000.

Much of the change that has occurred in Utah in the past 150 years is a result of non native species that have been introduced into the area. Native grasses have been replaced by crested wheatgrass, cheatgrass, Russian wildrye, and other species from Europe and Asia. Domestic livestock have replaced native grazers, and influenced vegetative changes from grasses and forbs to shrubs and trees in many areas, resulting in fewer bighorn sheep and more mule deer. Native fish in the Colorado River drainage have been displaced by exotic species such as carp, catfish, and an abundance of small minnows. Rivers have been dammed, providing reservoir habitat for large and smallmouth bass, yellow perch, walleye and

## Native Wildlife

*continued*  
**Native Wildlife**

rainbow trout. Many of these changes have benefitted man. Yet, they still have influenced the change in the wildlife community of the state. Other land management practices have influenced changes in native wildlife communities, including: energy development; fire suppression; urban development; and agriculture.

Changes in the status of nongame wildlife populations in the state have continued to be recorded over the past 22 years. With the signing of the federal Endangered Species Act in 1972, and the creation of the Nongame Wildlife Section in 1976, increased emphasis was placed on researching nonhunted species, or species in peril. Periodically since 1976, the Division has compiled a list of taxa of concern. In 1976, 64 taxa were listed as either extirpated, endangered, declining, or status questioned (Table 1). Either as a result of more extensive research and continued impacts on taxa, by 1998, that number had increased to 121. A similar trend was represented for taxa federally listed during that time period. In 1976, 13 taxa in the state had federal status. In 1999, 19 taxa were listed as extirpated, endangered, or threatened (Table 2). Table 2 numbers reflect listed, experimental, and proposed taxa.

*Table 1. Number of state sensitive vertebrate wildlife taxa listed as extirpated, declining or status questioned in Utah, 1976-98*

Year	Fish	Amphibians	Reptiles	Birds	Mammals	Total
1976	14	3	8	14	25	64
1980	16	3	10	25	40	94
1982	12	4	22	28	29	95
1987	20	4	22	24	29	99
1992	20	6	22	34	30	112
1998	22	6	25	30	38	121

Fish communities in the Colorado River drainage are a good example of changes that have occurred to native populations. Only 13 fish species are native to the Colorado River drainage. However, there are now 42 fish species that inhabit these waters. This has resulted in competition with and displacement of several fish species, including: the Colorado pikeminnow; humpback chub; bonytail; and razorback sucker, all of which are now federally listed as endangered.

*Table 2. Number of vertebrate wildlife taxa federally listed as extirpated, endangered or threatened in Utah, 1976-1999*

Year	Fish	Amphibians	Reptiles	Birds	Mammals	Total
1976	4	0	3	6	13	26
1980	5	0	6	5	16	32
1982	8	0	16	5	20	49
1987	11	2	26	5	26	70
1992	12	2	38	6	31	89
1997	10	1	27	6	26	70
1999	8	0	16	4	19	47

Issues identified that affect management of native wildlife populations were identified at a meeting in October, 1997. These include:

- *Broad-based inventories of populations needed to avoid Federal threatened or endangered classification;*
- *Impacts of introductions of exotic species;*
- *How to fund management activities for nonharvested (nongame) species;*
- *Public perception of nongame species;*
- *Role of nongame species in the ecosystem;*
- *Changes in habitat and effects on wildlife populations;*
- *Loss of specialized habitat, tendency of generalists to*

*increase, specialists to decrease;*

- *Population data compilation and accessibility;*
- *Impacts of federally listed species on local economies;*
- *Relationship of nongame management to other Division programs;*
- *Reduction in effort placed on nongame programs as a result of elimination of the Nongame Section and placing management responsibility for these species in the Aquatic and Wildlife sections;*
- *Difficulty in determining monetary value of nongame species;*
- *Discrepancies in taxonomic classification;*
- *Use of indicator species;*
- *Existence of relic, intact ecosystems; and*
- *Lack of public support (i.e., financial) for nongame programs;*

Native wildlife species have benefitted in recent years from increased awareness and management activities directed to recovering or stabilizing these populations. Peregrine falcons, once on the verge of extinction in Utah, are now found in many areas throughout the state and the population level exceeds the recovery goal set for this species. Bald eagles have increased throughout the United States, and at least 4 pairs now nest in Utah. Greater emphasis is now being placed on the management of passerine birds, particularly through the Partners in Flight program. River otters have been re-introduced to the state. Colorado pikeminnow populations are increasing in the Green River.

Changes in native wildlife populations over the next 15 years will depend to a great extent on management activities of the Division and other land management agencies, as well as private landowners and the public at large. Habitat enhancement that improves, or creates limited, specialized habitat can help stabilize populations of species dependent on those habitats. Adequate research and data collection will aid in the management of nongame species. Some species may be benefitted through transplants or changes in land management practices. Public perception of these species will play a large part in their management, and ultimately the changes that will occur.

# Threatened and Endangered (T&E) Wildlife

## ***Background***

The United States Endangered Species Act (ESA) was enacted by Congress in 1973 in response to the decline of plant and animal species. Species endangerment was attributed to “economic growth and development untempered by adequate concern and conservation” and “deplet(ion) in numbers.” Habitat loss may be either direct (urban expansion, highways, agriculture, etc.) or indirect (pollution, poisons, introduction of non native species). Depletion of numbers resulted from over-harvest and unmitigated control measures. In addressing the need for protection, Congress stated that threatened and endangered species “are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people.” This act set specific guidelines for management and control of threatened and endangered species, including: specific responsibilities and authorities, funding, penalties and enforcement, listing and delisting criteria, etc. Although revised many times since its inception, including reauthorization every five years, this act is still the primary directive for threatened and endangered species management in the United States.

The ESA strives to halt the decline of imperiled species through protection of the species and their habitats. To accomplish this, the ESA provides for mechanisms of listing, interagency consultation, recovery efforts, cooperative agreements, and legal protection of threatened and endangered species. When a species is listed, a recovery plan is developed identifying specific conservation measures deemed necessary to maintain long-term viability of that species. Under the ESA, The United States Fish and Wildlife Service may enter into cooperative agreements with state agencies for threatened and endangered species management and recovery efforts.

Recognition and legal protection of endangered species in Utah occurred slightly behind what progressed on the federal level. In 1971, the Utah Legislature included in code legal authority for the Utah Division of Wildlife Resources to manage protected wildlife: including specific reference to several sensitive and listed species. In 1975, the Utah Wildlife Board was given authority to add to the list of protected wildlife, any species listed under Section 3 of ESA.

The Division’s role in threatened and endangered species management has traditionally been in recovery planning and species research.

Management of aquatic endangered species in Utah followed directly on the heels of the 1966 Endangered Species Preservation Act. Two fish species, humpback chub and Colorado squawfish, appeared on the first endangered species list in 1967. Research into the life histories of these fish had begun as a result of construction of Flaming Gorge Dam and increased thereafter. Continued research into these species and their river habitats led, also, to the listing of two other Colorado River fishes and the realization that

the river system itself was endangered, not just the fish. In 1988, the various fishery management agencies and resource users agreed to a cooperative, 15-year program to direct recovery of the fish and river system while maintaining water resource uses. Similar events transpired on the Virgin River, where research on the woundfin led to additional listings and development of cooperative recovery strategies. On Utah Lake, efforts to recover the June sucker also led to establishment of a multi-faceted and cooperative conservation program examining recovery of the entire system within present and foreseeable uses. Over time, these programs have grown to include additional river systems, such as the San Juan and Price rivers.

While efforts identify scientifically credible recovery actions and provide sound biological information on the status of listed species, funding has been largely insufficient to implement recovery plan objectives for the delisting of more than a few select species. Funding for these programs occurs through Congressional authorization (\$39.7 million nationally in 1995) and cooperative agreements. Cost sharing is common, with states donating from 10% to 30% of the funding. Additional monies are donated by other federal and state agencies, and private companies involved in actions that impact endangered species.

Because of the ecosystem focus of aquatic recovery programs, they require considerable financial commitment. For example, since its inception in 1988, the RIP has spent \$54.9 million (primarily in Utah and Colorado) on Colorado River recovery efforts. Utah has spent an additional \$772,100 and BOR \$3.6 million on the same program. BOR funding for the San Juan River Recovery Program has totaled \$803,300 since 1992. These figures do not include contributions by Western Area Power Administration, counties, additional federal agencies and resource users.

However, lack of funding and broad support for all recovery activities has led to increasing conflicts between threatened and endangered species conservation and resource development. Therefore, in the past decade, threatened and endangered species management has progressed from the traditional reactive single species philosophy toward more active development of cooperative recovery programs and multi-agency planning processes.

### ***Current Status***

Presently, there are 39 federally listed species in Utah: two mammals, six birds, eight fish, one reptile, two invertebrates (snails), and 20 plants. The Division currently has recovery programs/actions in place for all but two of the animal species on this list. These programs are approximately evenly split between single species directives and multi-entity, cooperative plans for research and habitat enhancement/protection. In addition, the Division is developing survey and monitoring protocol for all native species. These programs will help to alert managers to potential problems before listing becomes imperative.



*continued*  
**Threatened and  
Endangered Wildlife**

Endangerment results from various impacts, often related to changes in habitat associated with man's use of resources. In Utah, the second driest state in the nation, man's impacts to habitat are complicated by the fragility and unique attributes of the land. Habitat recovery is often difficult and may take decades. Through the auspices of the Habitat Council and funds generated through Habitat Stamp sales, the Division is expanding its efforts to preserve and maintain critical habitats. The Division has also instituted programs to improve planning and management for Division-owned properties and increased effort to conserve other public and private lands through cooperative agreements.

Cooperative recovery implementation strategies provide for issue-based conflict resolution by establishing active involvement by stakeholders. Examples of collaborative recovery programs underway in Utah include: Virgin River Basin Integrated Resources Management and Recovery Program; Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin; Washington County Habitat Conservation Plan; and Habitat Conservation Plan for Utah Prairie Dogs in Iron County. These efforts serve to enhance, conserve, and recover federally listed threatened and endangered species through negotiated resource planning by local, state, federal, and private entities.

In the past four years, DWR has been pro-actively involved in species conservation through establishment of Conservation Agreements for management of species not yet listed under the ESA, but which may be considered for listing. Conservation Agreements are cooperative plans to implement actions which may remove or lessen threats which could lead to species listing. Conservation Agreements have been established for Virgin spinedace, Colorado cutthroat trout, least chub, and spotted frog. These agreements provide for stakeholder involvement in species and habitat management early in conservation strategy planning. They are more flexible than recovery plans and, if properly designed and administered, should eliminate the need for listing of many species.

***Future***

Approximately 650 vertebrate species, and an unknown number of invertebrate species, are native to Utah. A total of 139 of these already appear on the Utah Sensitive Species List because of declines in numbers, range and/or distribution. Several are being considered for federal listing. Little is known about most of these animals. Management methods, actions and funding must be directed into efforts that not only recover listed species, but also prevent additional listings.

In spite of what seems to be continual expansion in the threatened and endangered species list, there are success stories within the ESA. The bald eagle and Utah prairie dog have been down listed from endangered to threatened, the peregrine falcon is being con-

sidered for delisting, and recovery efforts may be benefitting the Colorado pikeminnow [formerly named Colorado squawfish].

However, pressures on threatened and endangered species are certain to increase as Utah's population and concurrent demands on resources increase. These stresses will not be limited only to those species already listed as threatened or endangered. Cooperative programs must expand, though, to include species and habitats on which we do not yet have sufficient information for management decisions. This will require escalation of efforts to identify demographics, ranges, life histories, etc. on a cadre of both aquatic and terrestrial species we presently know little about.

Furthermore, water resources in Utah will continue to be precious and scarce. Demand continues to rise and balanced use must be established. Water development usually impacts the entire watershed or basin. Therefore, management of aquatic species on a watershed basis is the only reasonable alternative to extinction and additional listings. Including all impacted entities in aquatics management programs provides greater understanding, involvement and incentive for cooperation. It also improves cost sharing while increasing potential funding sources.

However, these broad coverage tactics will not be sufficient if applied only to listed aquatic species. Evaluation of endangerment will probably shift to evaluation of habitat units, whether a watershed basin, a series of springs, or closed system lake. When some portion of a habitat unit shows signs of distress, it will be necessary to evaluate the entire aquatic system and reestablish balance for that entire system. If this occurs before species listing, restoration of the entire aquatic system may be accomplished, precluding the need for listing. Aggressive actions will be the key to managing endangered aquatic resources in Utah's future.

Increased efforts to recover terrestrial species and prevent species listing will also require additional expenditures in this realm. Although some increase in funding may be expected through ESA, this is not a completely reliable source, nor can these increases offset foreseeable costs. Therefore, cooperative conservation planning and agreements will become even more vital to endangered species activities. It will also become imperative to find additional sources of funding in a manner which equitably distributes costs to the public - the true owners of these species.

# Big Game

Utah Code 23-13-2(6) states “Big game” means species of hoofed protected wildlife. There are eight big game species currently hunted in the State of Utah. These are Rocky Mountain mule deer, Rocky Mountain elk, pronghorn, Shiras moose, bison, Desert bighorn sheep, Rocky Mountain bighorn sheep and Rocky Mountain goat (California bighorn sheep were released on Antelope Island State Park in March, 1997). All of these are believed to be or have been native to Utah. Over the last fifteen years the populations of all of these species, except Rocky Mountain mule deer, have increased resulting in expanded viewing and hunting opportunities.

## ***Rocky Mountain Mule Deer***

Since 1982, mule deer populations in Utah have declined by 40-60 percent. This decline can be attributed to habitat loss (urbanization, highways, conversion of shrub ranges to grass ranges by man, wild fires converting shrub ranges to grass ranges and natural succession of shrub ranges back to grass ranges) and catastrophic winter events as well as prolonged drought in parts of the state which have contributed to great winter losses of deer and summer losses of fawns as well as reduced the productivity and recruitment of potential fawns into the adult population of deer.

Deer hunting opportunities in Utah since 1982 have been reduced by approximately one-half. Current management plan objectives for deer populations have recognized the reduced potential for deer in Utah and established population management objectives to reflect reduced habitat carrying capacity. Hunter crowding has decreased and the quality of the hunting opportunity as well as the quality of the animals harvested have improved. Future hunting opportunities will be based on meeting management objectives of deer management plans.

## ***Rocky Mountain Elk***

Since 1982, elk populations in Utah have probably doubled. The same habitat changes which are detrimental to mule deer are advantageous to elk, except for urbanization which remains detrimental to all big game species.

Elk hunting opportunities in Utah have approximately doubled since 1982. Current management plan objectives for elk populations recognize the potential for elk in Utah and population management objectives have been set to reflect habitat carrying capacity. Future hunting opportunities will be based on meeting management objectives of elk management plans.

## ***Pronghorn***

Since 1982, pronghorn populations in Utah have tripled. Pronghorn are as responsive to habitat changes as any big game species and are even more responsive to adverse weather conditions. Utah’s pronghorn habitat is improving over most of the state. Severe drought conditions may impact pronghorn more severely than

adverse winter conditions. Opportunities for expansion of pronghorn in Utah will depend on habitat availability.

Pronghorn hunting opportunities in Utah have increased by three fold since 1982. Unit pronghorn management plans need to be developed to set population objectives.

### ***Shiras Moose***

Since 1982, Shiras moose populations in Utah have about doubled. The factor which seems to most severely impact moose in Utah is hot, dry summers; during these periods numerous moose are reported to have died. Veterinary necropsy results have indicated pneumonia like symptoms. Moose habitat is sensitive to urbanization also. Opportunities for expansion of moose populations in Utah seem to be very limited.

Moose hunting opportunities in Utah have approximately doubled since 1982. The Statewide Management Plan for moose will be completed in 2000. Moose unit management plans need to be developed to set population objectives.

### ***Bison***

The management objective for Utah's Henry Mountains bison herd is determined by cooperative agreement with the Bureau of Land Management. In the early 1990s the management objective was raised by 75 head following the purchase of live-stock grazing permits. Opportunities for future expansion of the Henry Mountains herd are very limited.

Bison hunting opportunities in the Henry Mountains have fluctuated with population size. During the early 1990s, significant cow bison removal took place to reduce the population. The management objective for bison on the Henry Mountains establishes the hunting opportunities for this herd. A bison herd established on Ute tribal lands may eventually provide hunting opportunities in other areas of the Book Cliffs.

### ***Desert Bighorn Sheep***

Desert bighorn sheep have nearly tripled their population in Utah since 1982. Current population size is approximately 2,600. Future expansion of desert bighorn sheep populations in Utah will be determined by a continued transplant program, the availability of suitable habitat and the ability to control disease problems.

*Table 1. Big game program overview by species*

PROGRAM COMPONENT	PAST (1982)	PRESENT (1999)	FUTURE 2010)
POPULATIONS			
ROCKY MOUNTAIN MULE DEER	600,000	320,000	400,000
ROCKY MOUNTAIN ELK	25,000	61,500	65,000
PRONGHORN	5,000	12,000	15,000
SHIRAS MOOSE	1,800	3,400	5,000
BISON	300	400	400
DESERT BIGHORN SHEEP	900	2,600	5,000
ROCKY MOUNTAIN BIGHORN SHEEP	<50	800	2,000
CALIFORNIA BIGHORN SHEEP	0	45	500
ROCKY MOUNTAIN GOAT	<100	800	1,500
RECREATION			
HUNTING			
DEER HUNTERS	238,000	108,000*	125,000
ELK HUNTERS	22,350	52,200*	50,000
PRONGHORN HUNTERS	445	1277	3,000
MOOSE HUNTERS	106	182	250
BISON HUNTER	28	102	50
DESERT BIGHORN SHEEP HUNTERS	11	33	40-50
ROCKY MOUNTAIN BIGHORN HUNTERS	0	5	10-20
CALIFORNIA BIGHORN SHEEP HUNTERS	0	0	5-10
ROCKY MOUNTAIN GOAT HUNTERS	1	24	60-75
NON-HUNTING			
NON CONSUMPTIVE USE	UNKNOWN <=Hunting	UNKNOWN >=Hunting	ANTICIPATED >Hunting

*\*Preliminary Estimates for 1999*

*continued*  
**Big Game**

Desert bighorn sheep hunting opportunities have tripled in Utah since 1982 and should increase into the near future. The Utah Bighorn Sheep Management Plan was completed and approved in 1999.

***Rocky Mountain Bighorn Sheep***

Very few Rocky Mountain bighorn sheep existed in Utah in 1982. Current population size is approximately 800. Future expansion of Rocky Mountain bighorn sheep populations in Utah will be determined by a continued transplant program, the availability of suitable habitat and the ability to control disease problems.

Rocky Mountain bighorn sheep hunting opportunities have increased from zero in 1982 to eight permits in 1999. The Utah Bighorn Sheep Management Plan was completed and approved in 1999.

***California Bighorn Sheep***

California bighorn sheep were released on Antelope Island State Park in March 1997. Much of northwestern Utah is potential habitat for this species. Future expansion of California bighorn sheep populations in Utah will be determined by a continued transplant program, the availability of suitable habitat and the ability to control disease problems.

California bighorn sheep hunting opportunities may be available in the future if populations can be established in other areas of northwestern Utah. The Utah Bighorn Sheep Management Plan was completed and approved in 1999.

***Rocky Mountain Goat***

Rocky Mountain goat populations in Utah have increased approximately ten fold since 1982.

Isolated areas of Rocky Mountain goat habitat exist in Utah. The distribution of this species is limited by social and political concerns. This species currently offers a unique viewing and hunting opportunity for the public. Based on the Division's Rocky Mountain Goat Management Plan the only area currently recognized for a transplant is Nebo Mountain.

## Background

Sixteen species (2.6 percent) of Utah's wildlife are classed as upland game. These species are legally hunted and generally possess three common characteristics—usefulness of flesh, feathers, fur or hide; ability to replace annual population losses, including those due to regulated hunting; and elusiveness or similar behavior that provides a unique or traditional challenge to hunters. These species are found in Utah's upland habitats as opposed to wetland habitats.

Utah has within its borders 13 species of birds classed as upland game. One of these species, the wild turkey, is comprised of two subspecies. Six of the birds, Gambel's quail, sage grouse, blue grouse, ruffed grouse, the Merriam's subspecies of the wild turkey and sharp-tailed grouse are resident native species. The mourning dove and the band-tailed pigeon are migrant natives that spend a part of each year in Utah. Two of the remaining five species are natives of the United States and have been successfully introduced into Utah. They are the California quail and white-tailed ptarmigan. The Rio Grande subspecies of the wild turkey is not native to Utah, but has been successfully introduced. The other three birds are exotic to the Western Hemisphere. The ring-necked pheasant is from China, the chukar partridge from India, and the Hungarian partridge from Europe. All upland game birds are currently hunted in Utah except for the Columbian sharp-tailed grouse.

Utah has three species of protected upland game mammals—two species of cottontail rabbit and the snowshoe hare and three similar mammal species in other classifications.

Three species of cottontail rabbits are found in Utah, the mountain cottontail, *Sylvilagus nuttallii*, the desert cottontail, *Sylvilagus audubonii*, and the pygmy rabbit, *Sylvilagus idahoensis*. Cottontails are widely distributed and occupy a variety of habitat types. The pygmy rabbit is not officially classed as an upland game species and is not legally hunted. However, some pygmy rabbits are unknowingly taken by cottontail hunters.

There are three hares found in Utah—the snowshoe hare, *Lepus americanus*, the black-tailed jackrabbit, *Lepus californicus*, and the white-tailed jackrabbit, *Lepus townsendii*. The snowshoe hare is the only hare classed as an upland game animal. The two species of jackrabbit are classed as non-protected wildlife in Utah and may be taken by hunters at any time with any weapon. No hunting license is required.

## Current Status

In 1997, some 54,125 upland game hunters harvested 424,908 upland game animals in Utah. They spent 388,937 days afield in pursuit of upland game. The ring-necked pheasant is the most popular of Utah's upland game species and the most popular game bird in Utah. In 1997, forty one percent of all small game or combination license holders and 70 percent of all upland game hunters pur-

# Upland Game

*continued*  
**Upland Game**

sued pheasants. The mourning dove is next in popularity. Forty two percent of all upland game hunters pursued doves. Twenty two percent hunted cottontail rabbits. Nineteen percent hunted forest grouse and eighteen percent hunted chukar partridge. Less than 100 hunters go afield annually to pursue the band-tailed pigeon and white-tailed ptarmigan.

In 1981, 6.3 percent of Utah's population hunted upland game. In 1997, a mere 3.0 percent of the population hunted upland game. During this same time period, the total number of upland game hunters afield decreased 44 percent, the number of upland game animals harvested decreased 48 percent, and the number of hunter days afield decreased 35 percent.

Since 1981, hunter harvest levels have declined dramatically on many of the traditionally most popular upland game species. For example, pheasant harvest in Utah has declined 66 percent, dove harvest 33 percent, cottontail rabbit harvest 59 percent and chukar partridge harvest 47 percent over the past 16 years.

There is serious discussion and efforts at the western states level to deter a potential listing of sage grouse and the Columbian sharp-tailed grouse as threatened or endangered species in the near future.

Because of declines in popular upland game species populations, contemporary Utah upland game hunters seem to be putting more effort into formerly underutilized species. Since 1981, forest grouse hunters have increased their days afield 15 percent and harvest of forest grouse has increased 12 percent. Hunter interest in wild turkeys in Utah has increased as well. Since 1981, Merriam's turkey harvest has increased 212 percent and days afield have increased 397 percent. There was no hunting season offered for the Rio Grande turkey in 1981. However, in the spring of 1997, two hundred twenty nine hunters harvested 127 Rio Grande turkeys for a success rate of 55 percent.

***Future Status***

The future for many upland game species is uncertain. Hunting, viewing and photographing opportunities will decrease for some species and stabilize and increase for others.

Hunting of Columbian sharp-tailed grouse was closed in 1979. However, implementation of permanent habitat through the federal Conservation Reserve Program (CRP) has allowed the species to stabilize. CRP will be prevalent in Utah for at least another 10-15 years. Possibly a limited entry hunting opportunity can be offered once again for this native rangeland grouse.

Hunting of sage grouse in Utah has been closed over the past eight years in many areas of the state. Sage grouse are hunted in only four "core" population areas. If sagebrush habitats for these birds are not improved significantly over the next 10-15 years, hunting could be eliminated indefinitely or the Division may have to con-

sider limited entry permits to control harvest in select areas of the state.

Despite the fact that the ring-necked pheasant is currently the most popular game bird in Utah, populations will continue to decline into the future. The federal CRP has done little in Utah to stabilize pheasant populations. Most Utah lands accepted into CRP are located in dryland agricultural areas and not in irrigated agricultural areas that pheasants prefer. The primary factor for pheasant population decline will be habitat loss and degradation as agricultural habitats are eliminated through urban and industrial development and changing land use practices. Pheasants in the future will most likely be found only in areas where excellent suitable habitat remains. Future pheasant hunting will occur on select private land and state wildlife management areas where suitable habitat can be maintained. Releases of pen-reared birds into these areas for put and take hunting might be necessary to accommodate hunters. Many of Utah's pheasant hunters are becoming members of Commercial Hunting Areas in order to ensure that they have the opportunity to harvest birds.

*Table 1. Upland game program overview by species.*

PROGRAM COMPONENT	PAST (1981)	PRESENT (1997)	FUTURE (2011)
<b>HUNTING (Overall)</b>			
Number of Hunters Afield	96,196	54,125	Stable/Decreasing
Upland Game Animals Harvested	813,163	424,908	Stable/Decreasing
Hunter Days Afield	597,033	388,937	Stable/Decreasing
<b>HUNTING (Number of Hunters By Species)</b>			
Ring-necked Pheasant	83,408	37,622	Decreasing
Mourning Dove	30,060	22,594	Stable
Band-tailed Pigeon	67	58	Stable
Chukar Partridge	12,907	9,665	Increasing
Sage Grouse	10,083	4,178	Stable/Decreasing
Forest Grouse (Ruffed and Blue)	14,329	10,206	Increasing
Quail (California and Gambel s)	4,946	3,637	Stable/Increasing
Hungarian Partridge	3,545	2,328	Stable
Wild Turkey (Merriam s)	115	339	Stable/Increasing
Wild Turkey (Rio Grande)	no hunt offered	229	Increasing
Sharp-tailed Grouse	closed	closed	Increasing
White-tailed Ptarmigan	no hunt offered	18	Increasing
Cottontail Rabbit	25,906	12,263	Stable
Snowshoe Hare	3,554	1,912	Stable/Increasing
<b>RECREATION</b>			
Percent of Utah's Population Hunting Upland Game	6.3	3.0	Stable/Decreasing

Mourning dove, band-tailed pigeon, Hungarian partridge, white-tailed ptarmigan, cottontail rabbit and snowshoe hare populations will probably continue into the future as they are now. Populations will continue to fluctuate annually based on weather, climatic and cyclic conditions. Annual habitat improvement projects will help to ensure that these populations remain stable. Hungarian partridge populations have benefitted from the federal CRP program as have sharp-tailed grouse. Hun populations might increase slightly over the next 10 to 15 years as permanent cover from CRP increases.

Chukar, forest grouse, quail and wild turkey populations will likely increase in the future. An aggressive water development program along with wild trapped/transplanted and limited pen-reared chukar releases should increase populations. Chukar populations are found almost exclusively on public lands in Utah, so hunter access should not be a problem.

A new attitude in the US Forest Service to regenerate aspen stands throughout Utah should reverse the long term downward trend in



*continued*  
**Upland Game**

forest grouse populations. Ruffed grouse will likely benefit most. Populations will increase as aspen stands are regenerated through the use of prescribed fire and clearcutting. Interest in ruffed and blue grouse is increasing as declines in pheasant populations continue.

Aggressive trap and transplant programs by the Division will improve quail and wild turkey populations. In-state trapping for transplant along with opportunities from other states will be the focus of Utah's wild turkey management program in the future.

As upland habitats have changed over time throughout Utah, so have population numbers for the guild of species classed as upland game. As upland game numbers in Utah decline so will hunter numbers. Some species such as chukar, forest grouse, quail and wild turkey that spend much of their time on public lands will be easy to manage and access. Other species such as pheasants and rangeland grouse such as sharptails and sage grouse that occur on private land or in declining habitats will reduce in availability. Some species populations such as mourning dove, band-tailed pigeon, Hungarian partridge, white-tailed ptarmigan, cottontail rabbit and snowshoe hare will likely remain the same for the next 10-15 years.

For purposes of this assessment the waterfowl program was divided into 4 program components; population status, harvest regulations, recreational demand and habitat. Each program component was quantified and described for three periods of time; Past (average of 1980-82), Present (average of 1995-97), and Future (2010). A summary of this assessment is shown in Table 1.

### ***Population Status***

All waterfowl are dependent on wetlands for at least part of their life history requirements. Because wetland abundance can be dramatically impacted by drought and human activity, waterfowl populations can fluctuate greatly through time. Continentally, most duck breeding populations are currently at or above their long term averages and some are at all time record highs. This is due to an unprecedented 3 year cycle (1995-97) of excellent breeding habitat conditions. It is unlikely that habitat conditions will remain as favorable in the future and we should expect continental populations to stabilize or decline.

Locally, duck breeding populations have declined from the early 1980s due to increasing predator populations and Great Salt Lake flooding. Predation will likely remain a serious factor in the future and local populations of ducks will probably decline. Avian botulism will also remain a significant mortality agent in Utah and the onset of fowl cholera in the early 1990s in Utah suggests that future losses of both locally produced ducks and migrants to disease may increase.

The Rocky Mountain Population (RMP) of Canada geese is the prevalent goose population breeding and migrating through Utah, although some smaller races of Canada geese, lesser snow geese, and Ross' geese frequent the state during migration. The RMP has shown a steady and sustained growth over the past 30 years and will likely stabilize or continue to increase at a slower rate in the future. Population growth has occurred in response to conservative harvest strategies and the favorable impact that agriculture has had on this population.

Like RMP geese, tundra swan populations have demonstrated a substantial and continuous growth over the last 30 years with approximately 90,000 birds in the western population. Although peak staging use of Utah marshes was severely reduced by Great Salt Lake flooding, our marshes have recovered and swan use is rebuilding to traditional levels. Staging use will likely continue to increase with population growth.

Two populations of greater sandhill cranes exist in Utah. They are the Lower Colorado River Valley Population (LCRVP) and the Rocky Mountain Population (RMP). At most, only a few pairs of LCRVP cranes exist in Utah due to limited habitat in the northwest corner of the state and it is unlikely that this population will expand. The RMP has shown growth both locally and regionally since the 1980s. In Utah we anticipate that the RMP breeding num-

## **Waterfowl/Cranes**

*continued*  
**Waterfowl/Cranes**

bers and distribution will continue to grow due to the presence of vacant or underutilized habitat in some areas of the state.

***Waterfowl Regulations***

All migratory bird harvest regulations are ultimately set by the federal government. Because these populations are shared by many states and countries, the annual regulation setting process is coordinated through a flyway process that includes affected state and federal agencies and any interested private organization. Once annual frameworks are finalized by the federal government, state regulatory processes are used to fine tune regulations within federal frameworks to meet state needs.

During the early 1980s, duck populations were high and hunting regulations were stabilized as part of an experiment to learn more about population regulation and harvest dynamics. Bag size and season lengths were fixed and few species restrictions and no sex restrictions were used in our regulation strategy. After the experiment ended in 1985, regulations returned to the historical approach of annually adjusting regulations to track changes in populations. Total bag, internal species and sex restrictions, and season length were annually used to adjust harvest.

Currently, the USFWS with cooperation of the states is developing an “adaptive” approach to duck regulations that will emphasize learning about how harvest impacts waterfowl populations and incorporate what is learned into future regulation decisions. This will likely mean that future regulations will continue to track waterfowl populations on an annual basis, but additional complexity regarding species and sex restrictions may increase as our knowledge of harvest and population dynamics grows.

Goose regulations historically have been less complex than duck regulations due to our greater understanding of harvest impacts on populations, but also because we are dealing with fewer species when we regulate goose harvest. Regulations are prescriptive in nature which allows liberalization when the population exceeds certain thresholds and requires harvest restrictions if populations decline below management objectives. This strategy has functioned well in the past and will likely prevail into the future.

Pressures that will guide the nature of future regulations include a need to increase our understanding of the impacts of regulations on populations, particularly for ducks; a clearer understanding of hunter motivation and desires; and simplification of the federal regulation process.

***Recreation***

Interest in waterfowl hunting in Utah appears to track waterfowl population status and local habitat conditions. Hunter numbers were relatively high during the 1970s and early 1980s when waterfowl populations were high and declined dramatically during the 1980s when waterfowl populations declined and Great Salt Lake

flooding destroyed most of the local marshes. Hunter numbers have recently recovered to some extent and some additional future growth is anticipated. Because recruitment of young hunters appears to be declining, it is unlikely that we will ever return to the peak number of waterfowl hunters we had in the 1970s.

Table 1. Waterfowl program overview by species

PROGRAM COMPONENT	PAST (1980-82)*	PRESENT (1995-97)*	FUTURE (2010)
<b>POPULATIONS</b>			
<b>DUCKS</b>			
LOCAL (Breeding pairs)	7,142	5,226	DECREASING
CONTINENTAL (USFWS breeding pop estimate)	30.5 Million	35.4 Million	STABLE/DECREASING
<b>GEESE</b>			
LOCAL (Breeding pairs)	706	825	STABLE/INCREASING
RMP	78,457	99,932	STABLE/INCREASING
<b>SWANS</b>			
UTAH STAGING	50,745	24,740	INCREASING
WESTERN POPULATION	80,025	91,176	INCREASING
<b>CRANES</b>			
UT SUMMER POP	208	601	INCREASING
RMP	10-15,000	15-20,000	SAME
<b>CURRENT POPULATION PRESSURES</b>			
Predation increasing locally and abroad			
Disease agents increasing locally and abroad			
Agriculture favoring geese/cranes/swans, harming ducks			
<b>WATERFOWL REGULATIONS</b>			
	Stabilized Simple	Adjusted Annually More complex Passive Adaptive Some Prescriptive	Fully Adaptive More Complex
<b>CURRENT REGULATION PRESSURES</b>			
Increasing public involvement/interest			
Increasing diversity in consumptive users			
Need for improved understanding of harvest impacts			
National interest in simplifying regulation process			
<b>RECREATION</b>			
<b>HUNTING</b>			
HUNTER NUMBERS	39,007	32,172	SLIGHT INCREASE
% JUVENILES IN POPULATION	15.7%	5.1%	STABLE/DECREASEING
WATERFOWL HARVEST	386,469	228,937	STABLE/INCREASING
DAYS AFIELD	246,633	201,000	STABLE/INCREASING
<b>NON-HUNTING</b>			
VISITATION ON STATE WMAs	UNKNOWN <=Hunting	UNKNOWN >=Hunting	ANTICIPATED >Hunting
<b>CURRENT RECREATION PRESSURES</b>			
Demand exceeds supply			
Limited funding for user facilities			
Growing conflicts between users			
Increasing diversity of users			
Recruitment of young hunters declining			
<b>WATERFOWL HABITAT</b>			
<b>STATE AREAS</b>			
#AREAS	18	21	STABLE/INCREASING
ACREAGE	80,037	96,000	STABLE/INCREASING
<b>FEDERAL REFUGES</b>			
#AREAS	3	3	STABLE
ACREAGE	93,483	103,987	STABLE/INCREASING
<b>CURRENT HABITAT PRESSURES</b>			
GSL Flooding/drying			
Urban/industrial/transportation growth			
Water demand changing quality/quantity/timing of supply			
National/Regional habitat initiatives are increasing			

Although accurate information on non-hunter use of our waterfowl management areas is lacking, we anticipate visitation of our areas by non-hunters will likely exceed hunter use in the future.

If current trends in user growth continues, the demand for a diversity of recreational opportunities will far exceed our capability to

*continued*  
**Waterfowl/Cranes**

provide them unless visitor programs and facilities can be expanded.

***Waterfowl Habitat***

Since 1981, the size and number of state and federal management areas has increased. Although future expansion will depend on willing sellers, availability of funding and legislative approval, it is likely that some acquisition will occur in the future.

Pressures that will impact future habitat status include weather and its impact on Great Salt Lake levels; the extent of urban/industrial/transportation growth; and the concurrent impacts to the quantity, quality, and timing of water delivery to our marshes. National and regional initiatives to protect and create wetlands, such as the North American Waterfowl Management Plan and provisions of the 1997 Farm Bill, are also increasing which should help mitigate the numerous and substantial pressures that negatively impact wetland quality and abundance.

These species are divided into three separate groups: 1) furbearers which are aquatic and terrestrial (Table 1), 2) black bear and 3) mountain lion. Although some states classify the mountain lion and the black bear as big game species, in Utah they come under the classification of special game species. These species were under the jurisdiction of the Game Management Section until 1982 for furbearers and 1986 for cougar/bear. All of these species were transferred and managed through the Non game Section. They remained under the management of the Non game Section until 1994 when the Non game Section was disbanded. Currently, all species are now being managed through a much streamlined Wildlife Management Section.

At various times in the past all but two of these species were classed as predators, or the subject of bounty payments, or both. Although Utah did not attain statehood until 1896, it was eight years earlier that the Territorial Legislature initiated bounty payments on "obnoxious animals." The act of March 3, 1888, read in part:

*The several counties of this Territory, are hereby authorized.... to ....pay rewards.... not to exceed one dollar each on lynxes, gray wolves and wild cats, fifty cents on coyotes, five dollars on mountain lions and bears, two cents on jack rabbits and ground squirrels, ten cents on musk rats, mink and weasels, five cents on gophers and one quarter of a cent on English sparrows....*

There remained a bounty of some sorts on these various species until the Utah Agriculture and Wildlife Damage Prevention Board was established in 1975. At that time the board terminated predatory animal bounty payments and no bounty has been provided since by the legislature. The trend over the past years has been to direct less attention to bounty payments and more attention to predator control.

### **Furbearers**

Since 1981, an average of 1,320 fur harvesters have taken an average of 45,000 protected and unprotected furbearers. The average combined value for furs from 1981 to 1987 was \$850,000 and from 1988 to 1997 is \$320,000 approximately. This is a substantial decline in the average fur value and the average number of furs taken over the past several years. This is the result of many factors such as; 1) reduced interest as shown in a decline in permits sold, 2) reduced fur prices paid by fur buyers, and 3) reduced demand for furs on the world market.

### **Terrestrial Furbearers**

Terrestrial furbearers are those that reside for the major portion of their life on land and do not rely on water for their complete survival. In the case of almost all canids in this category, data indicates that populations are very healthy and have actually increased (i.e., coyotes and red fox). Other canids appear to be stable and should remain so under current management. Mustelid populations appear to be in good health. Striped skunk populations have

## **Cougar/Bear /Furbearer**

*continued*  
**Cougar/Bear/Furbearer**

increased dramatically according to trapping harvest data and reported nuisance incidents. Bobcat populations are healthy and stable under current conditions and trapping levels. Bobcats will remain healthy and consistent with available prey sources. Please see species accounts below for specific information on species that deserve special attention.

**Kit Fox**

Current harvest of kit fox is low compared to 1982 to 1988, yet it is greater than expected based on trapper effort. The number of trappers attempting to take kit fox averages 103 trappers per year. Because there is little interest in trapping kit fox the sample sizes are small and inferences from harvest data are tenuous. Kit fox is a species that is limited due to habitat constraints. Additional indices to harvest data have been researched and should be implemented in the kit fox management program. Populations appear to be low but are healthy and should remain healthy under the current trapping pressures.

**Lynx**

Until recently there has been a lack of organized information concerning the distribution and status of the lynx in the 7 western states of the lower 48 (Colorado, Idaho, Utah, Montana, Oregon, Washington and Wyoming). These states make up the southern limits of the lynx's distribution. Lynx are protected in Wyoming, Colorado, and Utah. Records of lynx have been reported for most mountain ranges in Utah, but the validity of some of the observations is questionable. There are 9 confirmed, 8 probable, and 6 possible lynx occurrences documented in Utah since 1957. The lynx is currently being considered by the US Fish and Wildlife Service to be listed as a threatened species. Utah is in need of data documenting our current distribution of lynx and habitat selection. Protection of habitat in particular over the next 15 years may be paramount in the survival of lynx in Utah, if there are lynx currently present.

Table 1. Furbearing animals of Utah, 1825-1997

Common Name	Scientific Name	Legal Status	Population
Terrestrial Furbearers			
Badger	Taxidea taxus	Furbearer	Common
Bobcat	Felis rufus	Furbearer	Common
Coyote	Canis latrans	Not Protected *	Common
Gray Fox	Urocyon cinereoargenteus	Furbearer	Common
Kit Fox	Vulpes velox	Furbearer	Limited
Red Fox	Vulpes vulpes	Furbearer	Common
Lynx	Lynx canadensis	Protected	Rare
Marten	Martes americana	Furbearer	Limited
Raccoon	Procyon lotor	Not Protected *	Common
Ringtail	Bassariscus astutus	Furbearer	Limited
Spotted Skunk	Spilogale putorius	Furbearer	Common
Striped Skunk	Mephitis mephitis	Furbearer	Common
Long-tailed Weasel	Mustela frenata	Furbearer	Common
Black-footed Ferret	Mustela nigripes	Endangered	Endangered
Wolf	Canis lupus	Endangered	Endangered
Wolverine	Gulo luscus	SOSC <sup>1</sup>	Rare
Aquatic Furbearers			
Mink	Mustela vison	Furbearer	Limited
Muskrat	Ondatra zibethicus	Not Protected	Common
River Otter	Lutra canadensis	Protected	Rare
Beaver	Castor canadensis	Furbearer	Common

<sup>1</sup>species of special concern

**Marten**

Marten are most common in dense conifer stands of fir, spruce, hemlock, or lodge pole pine. Prime habitat generally includes fall-

en logs, stumps, and shrubs. In Utah they are found in the higher altitudes where access is very limited especially in the winter months. Marten are very much at home in areas that receive copious amounts of snow fall during the winter months. The documented distribution of marten in Utah is on both the north and south slopes of the Uinta Mountains and south along the Wasatch range to the Fish Lake National Forest.

Recent studies have found that marten populations in the Uinta Mountains are healthy. Research has found that habitat and prey base is a limiting factor to marten presence. Populations will continue to be healthy under current pressures and management. Habitat loss should be a major concern in the management of marten as they are very dependent upon old growth forests and voles as a major prey source.

### ***Ringtail Cat***

Indicators show that this species may be at low numbers in most areas of the state that they inhabit. Little information is available on distribution and behavior for this species in Utah. Special concern may be warranted if indicators remain low.

### ***Wolverine***

Biologists share a general sense that wolverines occur in low densities whether they are using optimal or sub optimal habitat. It has been suggested that density of wolverine is closely related to diversity and abundance of food sources. It seems that wolverine numbers have dropped considerably during the first half of this century from persecution as a predator and a nuisance to trappers trap lines. Other possible reasons for apparent decline are increased disturbance from humans in previously inaccessible areas and loss of habitat.

In a recently completed assessment and inventory of wolverine in Utah there were 26 probable and 55 possible occurrences of wolverine in Utah. This species is found in very low numbers in Utah and may require habitat protection and additional research to better understand distribution and habitat needs.

### ***Black-footed Ferret***

The black-footed ferret is considered the rarest mammal in North America, and one of the rarest in the world. It is the only ferret native to North America. Habitat loss and prairie dog control programs beginning in the early 1900's led to a sharp decline in ferret numbers and near extinction of the species. Because of this, black-footed ferrets were protected under the Endangered Species Preservation Act. A black-footed ferret was found and confirmed in 1949 in San Juan county. This has been the only confirmed incident in the state although several sightings have been reported over the past 20 years. Between 1910 and 1942, 6 specimens were collected in Rio Blanco and Moffat counties, Colorado, which are adjoining counties to Utah which has contiguous habitat across state lines. A management plan was pre-approved by the Wildlife



*continued*  
**Cougar/Bear/Furbearer**

Board for the reintroduction of black-footed ferrets to eastern Utah in the fall of 1999. A Colorado/Utah working group introduced preconditioned offspring (kits) from 18 ferrets which were raised in breeding pens. On October 21st, 1999, 26 black-footed ferrets were released in Coyote Basin, Utah, with a total population of about 72 ferrets now released; a 10% survival rate is typical, but so far counts indicate a higher rate. The full degree of success at colonization is as yet unknown.

***Black Bear***

Very little is known of the historical status and distribution of black bear in Utah. Since 1981, hunters have been required to have their bear checked by the Division in order to obtain improved management information. Realizing the sensitivity of bears to hunting, three specific research projects were initiated in 1986 another in 1991 and another in 1997 to gather detailed information on bear density, food habits and habitat use in hunted and non-hunted populations. Data from these studies have helped to evaluate habitat throughout the state and the potential of these areas to support healthy bear populations. The Division is currently contracting to research the use of genetics in determining confidence intervals in estimated populations of black bears.

An area of concern is the increased number of nuisance calls and bears killed by Wildlife Services specialists. With increased back country use it is important that the public be educated about bears and bear country. The average number of bears killed due to nuisance or for depredation reasons has increased from 1977 through 1998. The number of males versus females in the harvest indicate that population demographics are healthy and that reproductive potential is intact. This information as well as research indicates that populations have increased and are very healthy and will continue to be under current pressures and management. Concerns should be in habitat loss and human encroachment on bear habitat. A citizen working group representing diverse wildlife interest is currently drafting a black bear management plan that is scheduled for release in draft form by the end of March, 2000.

***Cougar***

The mountain lion, or cougar, is the most abundant of Utah's two large predators, the other being black bear. The species is widely distributed throughout the state. The mountain lion is a protected species. The lion's abundance allows the Utah Division of Wildlife Resources to manage it for hunting as well as numerous other recreational, educational, and ecological purposes. Through responsible management practices, the cougar and other wildlife species have been conserved so they occur in the numbers that all of society may enjoy, now and into the future.

Although our wildlife resources are a national and state treasure, certain species sometimes conflict with other humans values. For example, the cougar's livelihood depends on killing and eating other animals. It's common for cougar to prey on a rancher's live-

stock. The species main prey is the mule deer. When livestock are killed or when the hunting public perceives that lions are consuming large numbers of deer, the conflicts between this large predator and humans become very apparent. This condition presently occurs in Utah, as well as several other western states.

In response to these conflicts as well as concern for human safety, the DWR has increased cougar harvest permits on selected units each year since 1995. This response has been at least partly responsible for the increase in number of hunters afield and cougar harvested during the interim period. The 30 year average number of cougar taken by hunters is 231 cougar while the 10 year average is 338. The average number of cougar taken over the past 5 years is 437. These figures show a constant increase in the number of cougar taken and they also provide evidence that indicates populations were probably increasing in numbers over the years previous to 1995-96.

Several recent studies have indicated that cougar populations were estimated between .06 and .10 cougars/mi<sup>2</sup> in their respective research areas. Under current management methods and hunting strategies populations in general should remain stable. However, in some areas of Utah data indicates that populations maybe declining; what rate of decline remains an unanswered question and presents a question of concern to the Division. Research is currently under way to better understand effects of hunting cougar and how to better estimate cougar populations. In 1999 the Utah Wildlife Board approved a citizen advisory, discussion group generated, cougar management plan for the state that guides wildlife managers based on biological, ecological, and social parameters.

### ***Aquatic Furbearers***

Aquatic furbearers are those that reside for the major portion of their life or require water for their complete survival. All species in this category appear to be in excellent condition population wise. Due to these species' special habitat requirements, special consideration needs to be given to habitat preservation and special trapping regulations, such as those on the Green River through Utah. Please see species accounts below for specific information on species that deserve special attention.

### ***River Otter***

The Division of Wildlife Resources, with help from the Utah Trappers Association, The Utah Wilderness Association, and many elementary, junior and high school groups, were successful in completing efforts to reestablish a self-sustaining population of river otters on the Green River from 1989 through 1994.

Wildlife Resource biologists reviewed all available information and determined that river otters were native to the Green River. The DWR then felt that reestablishing a self-sustaining population would refill a then vacant niche they once occupied, and would contribute to the ecological diversity of the Green and Colorado

*continued*  
**Cougar/Bear/Furbearer**

River drainage. Otters also provide recreational value in the form of viewing opportunities to those persons using the river, such as fishermen, rafters, and campers. Many individuals have reported observing otters along the Green River and were very excited to have this opportunity. Publicity surrounding the river otter reintroduction also helps to increase public awareness of issues such as wildlife conservation, impacts of water pollution, and the value of riparian and wetland areas. Division biologists concluded that the river segment between Flaming Gorge Dam and the state line would support river otters. Otters were not expected to inhabit the reservoir but several have actually dispersed to the reservoir and now call it home. Otter tracks were observed in Cache County, in the winter of 1998. A small population resides in Grouse Creek in the Raft River Mountains.

In 1996-97, a river otter was taken on the Logan River accidentally by a trapper. This indicates that river otter are in other river systems around the state but in very small numbers. River otter are very limited in distribution in Utah and more information such as habitat selection, behavior and distribution is badly needed for the management of this species in Utah. Other supplemental releases could be considered to increase the gene pool and the health of the population.

*Table 2. Furbearer program overview by species*

Program Component	Past 1988-1989	Present 1997-99	Future 2010
Populations			
Furbearers	Stable	Stable	Stable
Black Bear	Stable/Decreasing	Stable	Stable
Cougar	Stable/Increasing	Stable/Decreasing	Stable
Regulations			
Furbearer	Stabilized/Simple	Stabilized/More Complex	Adaptive
Black Bear	Stabilized/Simple	Stabilized/More Complex	Adaptive
Cougar	Stabilized/Simple	Stabilized/More Complex	Adaptive
Recreation Hunting/Trapping			
Furbearer	1,358	1,240 *(1996-97 figures 1997-98 figures are unavailable as yet)	Stable/Decr.
Black Bear	687	197 **(Estimate only)	Stable
Cougar	525	1,496	Decreased
Non-Hunting/Trapping			
Visitation to back-country	Unknown <=Hunting	Unknown >Hunting	Anticipated >Hunting
Habitat			
Furbearer	Stable/Decreasing	Decreasing	Decreasing
Black Bear	Stable/Decreasing	Decreasing	Decreasing
Cougar	Stable/Decreasing	Decreasing	Decreasing

## Sport Fish

Utah is a trout fishing state. The mountainous nature of Utah has meant that most fisheries are cold water with limited warm water habitat. Approximately 75% of Utah's anglers fish for trout. Close to 75% of the angling in Utah occurs on reservoirs and 25% on streams. Utah is the second driest state in the nation and unlike many neighboring states it was not blessed with hundreds or thousands of miles of high quality trout streams. Utah has less than 100 miles of "blue ribbon" trout streams. Historically, Utah's sport fish species were very limited. Only 2 subspecies of cutthroat trout (Bonneville and Colorado River), 3 subspecies of whitefish (Bear Lake, Bonneville and mountain) and the Bonneville cisco were native to Utah. All other trout, salmon, grayling, and warm water fishes that anglers enjoy in Utah were introduced from other states and countries.

The historical trend has been ever increasing numbers of anglers, increasing fishing pressure and increased numbers of fish caught by anglers. Meeting this increasing need with a limited amount of natural resources has meant a heavy demand for hatchery fish. Deteriorating water quality and natural habitats has also led to the stocking of more species of fish that historically were not native to Utah. An increasing number of reservoirs that historically produced good trout fisheries are no longer capable of sustaining trout populations. Water quality has deteriorated, oxygen depletions occur in the deeper, colder waters each summer and trout cannot survive in warm, surface waters. These cool water habitats are providing good habitat for various warm water sport fishes. Native species concerns are and will continue to limit the use of these non-native species in certain areas. A stocking policy was developed by the Division that will help address some of the concerns.

In the past, hatchery production was predominately smaller fish; fingerlings (3 - 8") and fry (1 - 2"). Today few if any waters are stocked with small fingerlings. Most waters are either stocked with advanced fingerlings, sub-adults or catchable sized fish. Hatchery improvements funded through the CUP at Kamas and Fountain Green hatcheries when accomplished, will only increase production by an additional 110,000 pounds. Loa, Midway and Springville hatcheries would also have to be remodeled by 2010 in order to come close to projected needs. Increased angling pressure, increased competition with other fish and deteriorating water quality are driving the need for more and larger fish. More fish will also be needed for urban (kids) fisheries in the future so that our ever urbanizing population can continue to experience the joys of fishing.

Fishing regulations have become more complex and more restrictive over time. That trend is going to continue and probably at an accelerated pace. More restrictions will be necessary to spread the available resource to more anglers and to take advantage of opportunities to manage more waters with wild fish. Managing some waters for wild fish will not reduce the overall need for hatchery fish. Major fisheries in Utah are reservoirs. Most reservoirs do not

*continued*  
**Sport Fish**

have the available spawning habitat to sustain wild fisheries even under reduced harvest regulations. Limited high quality habitat in Utah will continue to dictate the need for hatchery fish to meet an ever increasing angler demand and to meet the wide array of angler interests.

One other factor that could have a big impact on wild fish management is the spread of whirling disease. This disease could negate wild fish management on some waters and require the stocking of larger sized trout to replace lost wild fish. Furthermore, the cost to either build or maintain hatcheries located near waters where whirling disease has been found will increase due to the need for raceways to be covered/enclosed to protect their waters and trout from possible transmission of whirling disease.

*Table 1. Sport fish program overview by species*

SPORT FISHERIES	PAST -1980	PRESENT -1995	FUTURE -2010
Anglers &Fishing Effort			
Number Anglers	436,771	514,976	625,000
Tot.No.Days Fishing	3.24 million	5.56 million	INCREASING
Ave.Days/Angler	7-8 days/year	11 days/year	STABLE
Angler Catch			
Total Catch	10 million fish	23 million fish	INCREASING
Catch Rate (fish/hr)	0.82	1.05	STABLE
Hatchery Production			
Number of fish	19.8 million	10.2 million	10.3 million
Pounds of fish	0.82 million	0.92 million	1.8 million
Regulation Trends			
#Waters with reduced trout limits	3 waters	34 waters	INCREASING

### ***Introduction***

Invertebrates are the most abundant animals that exist on earth comprising more biomass than any other animal taxa (Arms and Camp, 1988). Invertebrates can be defined as those species of animals that lack vertebrae. They are often broken into two groups; the lower invertebrates and the higher invertebrates. The lower invertebrates include those taxa that have simple body forms and are believed to have originated early in evolutionary history. These include the phyla Porifera (sponges), Cnidaria (jellyfish and corals), Platyhelminthes (flatworms), Nematoda (roundworms), and Rotifera (rotifers). The higher invertebrates have more complex body forms and their embryos develop from three major layers of cells. These include the phyla Annelida (segmented worms: earthworms and leeches), Mollusca (snails, clams, octopuses, and squids), Arthropoda (arachnids, crustaceans, insects, millipedes, centipedes), Echinodermata (sea stars, sea urchins, sea cucumbers), and some members of Chordata (tunicates, amphioxus).

The majority of invertebrate groups inhabit aquatic environments, particularly marine environments; however, some groups, such as the rotifers, are most commonly found in freshwater environments. Only one group comprises many terrestrial species, the arthropods (spiders, millipedes, centipedes, and terrestrial insects).

Representatives of most invertebrate groups occur in Utah, the most common and best represented of the groups being the arthropods and mollusks. Literally thousands of species in these two groups alone are known to occur in Utah, and it is estimated that thousands more species have yet to be found and identified.

### ***Environmental, Recreational, and Economic Importance***

Invertebrates are a very important part of the ecosystems in Utah. Most invertebrates provide important prey sources for all other taxonomic groups including mammals, birds, reptiles, amphibians, and fishes, as well as other invertebrates. Insects perform many roles that are vital to human life. Without bees and other insects, many flowering plants, both wild and domestic would never be pollinated and thus would go extinct. As another example, terrestrial insects are a primary food source, both as adults and larvae, for most fish species, particularly the salmonids (Needham and Christenson, 1927, Hunt, 1975, Pennack, 1989). Other invertebrates such as plankton (floating organisms) also provide a constantly renewed source of food in aquatic habitats for smaller species including fish and amphibians. Invertebrates such as beetles, ants, and flies play a very important role in the environment as decomposers that break down the dead bodies of plants and animals. Aquatic invertebrates, such as the mollusks, may also play a significant role in water quality. Many act as “water purifiers”, that is, they filter many substances from the water, thereby improving water quality. Others play an important role as indicators for the overall health of the environment. Many species can survive only in water of high quality. If declines in these species occur, it usually is a signal that

## **Invertebrates**

*continued*  
**Invertebrates**

something may be wrong with the water that could pose a potential threat to humans and other wildlife.

Many invertebrates, such as crustaceans, provide a source of both food and recreation for humans. In Utah, the most common invertebrates collected for food are crayfish. Earthworms are a popular source of bait used for fishing and the commercial harvest of earthworms has become a source of income for many individuals in Utah. In addition to earthworms, the commercial harvest of brine shrimp and brine shrimp eggs has resulted in a several million dollar industry annually (Pettengill, 1991 letter to Timothy Provan, DWR Director). Currently, the brine shrimp industry in Utah supplies more than 90% of the world's annual demand.

Humans have devoted many years researching various methods for killing and eliminating insects because of the damage they cause to agriculture and for health reasons due to bites, stings, and transmission of diseases (Arms and Camp, 1988). However, many carnivorous invertebrates, such as dragonflies and spiders, play a significant role in pest control. Regardless of their relationship with humans, invertebrates are an integral part of ecosystems.

**Status in Utah**

Invertebrates have rarely been a top management priority because they have not appealed to the general public and there has been a lack of available funding. Consequently, distribution and abundance data for most invertebrates is minimal or lacking all together. Studies and investigations of invertebrates were fairly popular in the early 1900s (Pack, 1930, Needham and Christenson, 1927, Chamberlin and Jones, 1929, etc.), but with the shift to more specialized scientific issues such as genetics, evolution, and population ecology in the latter part of this century, life history studies have emphasized other high profile taxa associated with medicine or the conservation of sensitive species. Recently, however, studies on mollusks have become more of a focus in Utah, mostly due to increased concerns by the US Fish and Wildlife Service (FWS) over declining populations (Toone, 1991; Clarke, 1991 and 1993; Hershler, 1995).

Several regulations are currently in place for a few taxonomic groups of invertebrate species at federal and state levels. Currently, there are five species of invertebrates on the FWS' threatened, endangered, and candidate species list (50 CFR 17.11 & 17.12, 50 CFR Part 17) that occur or formerly occurred in Utah. These include the Kanab Ambersnail (*Oxyloma haydeni kanabensis*) - Endangered, desert valvata snail (*Valvata utahensis*) - Endangered, Ogden Desert Mountainsnail (*Oreohelix eripherica wasatchensis*) - Candidate, Bonneville Pondsnailed (*Stagnicola bonnevillensis*) - Candidate, and the Coral Pink Sand Dunes tiger beetle (*Cicindela limbata albissima*) - Candidate. Prior to the reclassification of candidate species by the FWS, an additional 21 Utah species (14 snails and 7 insects) were listed as Category 2 species. Category 2 species

were those species that were under consideration for listing under the Endangered Species Act of 1973.

Currently, crustaceans (crayfish and brine shrimp), and mollusks are the only invertebrates that are protected and/or regulated under Utah law (Wildlife Resources Code of Utah, Title 23). Prior to 1997, the only invertebrates specifically regulated by the state were crayfish, brine shrimp, the Kanab Ambersnail and a few exotic species (R657-3). In 1997, however, an additional 17 mollusks were added to R657-3 and the state's sensitive species list. In response to the increasing concern over the status of Utah's aquatic ecosystems, the Aquatic Native Species Program within the Aquatics Section of the Division is developing inventory and monitoring plans for aquatic animals in addition to fishes, mollusks, reptiles, and amphibians. As part of this effort, two DWR GIS data bases have been initiated and are being developed that summarize both secondary literature sources as well as some limited museum and collection information on the mollusks that occur in Utah.

### ***Future***

Interest in North America ecosystems, particularly the aquatic ecosystems, has grown significantly. This interest has intensified recently due to concerns for environmental quality, conservation of species, and outdoor recreation. Because of the recent shift toward a management approach based on conservation biology, natural resource agencies are now giving more attention to the more sensitive and rare wildlife species, including invertebrates.

The regulatory authority and accountability for mollusks has been determined to reside with the Division. Resource agencies will need to determine when and where the regulatory authority and accountability for the vast number of other species called invertebrates will reside before inventory, monitoring, and conservation can proceed.



## Plants and Plant Communities

Worldwide there are about 250,000 known species of vascular plants, including the ferns, fern allies (club mosses, horsetails, etc.), gymnosperms (cone-bearing seed plants), and flowering plants (Wilson 1988, Campbell 1996). Non-vascular plants include the mosses, liverworts, and hornworts and comprise more than 16,000 known species. Some current researchers also include the green algae and red algae in the plant kingdom based on molecular genetics and other evidence; these algae inhabit aquatic and marine environments and add approximately 11,000 known species. Mushrooms and other fungi (including the molds and yeasts) comprise another major group of organisms (approximately 85,000 known species) that is neither plant nor animal. Lichens (> 25,000 known species) are not plants but actually symbiotic associations of fungi and algae.

A plant community (e.g., ponderosa pine/Gambel's oak woodland) is defined as a pattern of co-occurring plant species that is repeated and maintained over the landscape (Bourgeron and Engelking 1994). Vegetation patterns occur at different spatial scales from an individual plant, to local plant associations, to major biomes at the global scale (e.g., northern coniferous forest, temperate grassland, subtropical desert, tropical rain forest). Plant communities also change over time through disturbance (e.g., fire) and the process of ecological succession following disturbance. In addition, vegetation can be classified as natural (not significantly affected by human activities), semi-natural (e.g., influenced by introduction and spread of alien plant species such as cheatgrass), or cultural (orchards, lawns, etc.). Plant communities are often used as an indicator of the presence of certain ecosystems or ecosystem processes.

### ***Evaluation of Plants and Plant Communities***

Green plants use energy from sunlight to manufacture their own food (a process called photosynthesis), and hence from an ecosystem perspective they are the source of energy on which virtually all other life depends (Campbell 1996). Also during photosynthesis, carbon dioxide is incorporated into plant tissues and oxygen is released into the atmosphere. Plants are thus extremely important for reducing levels of atmospheric carbon (thus buffering the effects of global warming) and increasing atmospheric oxygen (necessary for humans and other animals to breathe).

For the purpose of identifying management issues and problems, the characteristics of vegetation may be grouped into five broad, value-oriented categories: amenity, human safety, ecological, economic, and intrinsic (McBride 1977). The various values or functions of vegetation are interrelated. The following discussion provides some further explanation for four categories of vegetation evaluation.

- **Amenity Value** - The amenity value of vegetation is related to its positive or negative contribution to visual and historical quality, recreational potential, noise abatement, reduction of air pollution, and climate amelioration.

- **Ecological Value** - Vegetation is a critical component in the function of the regional ecosystem and the maintenance of wildlife habitat. The vegetation cover of the area similarly plays an essential role in the control of soil erosion and the maintenance of water quality. These factors are examples of the ecological function of vegetation. The presence of certain plant species or vegetation types can be valuable also as an indicator of environmental conditions (e.g., shallow or poorly drained soils and seepage areas). Other important ecological considerations include the tendency toward natural vegetation change over time (succession) and the capacity of vegetation to accommodate disturbance and development-related activities (fragility).
- **Economic Value** - The economic value of vegetation lies in its fiscal impact on the community. Direct fiscal impact is exemplified by the commodity resources (e.g., forest products) derived from vegetation along with any tax revenues generated by these resources, less the cost of resource management. The same vegetation attributes that pose a threat to human safety may cause a negative fiscal impact through loss of property. In addition, the amenity value of vegetation (its contribution to visual and historical quality and to recreation potential) may be capitalized in local real estate values, and may further contribute to the economic well-being of the community by stimulating recreation and tourism.
- **Intrinsic Value** - Plant species, and whole natural systems as well, have both a potential importance to human welfare and an intrinsic value beyond the realm of human estimation. The rationale for preserving genetic resources and natural diversity is thus partly utilitarian and partly philosophical. Future opportunities for teaching and scientific research also depend on the preservation of viable plant populations and intact natural systems.

### ***Status in Utah***

In Utah, there are 2,602 species and 393 infra specific taxa (subspecies or varieties) of vascular plants that are considered native (Welsh et al. 1993). Estimates of the number of species of non-vascular plants, fungi, and lichens in Utah are not readily available. The state of Utah is remarkable for its rich native flora and especially for its large number of endemic and rare plants. Within the continental United States, there are only four other states (i.e., California, Florida, Texas, and Oregon) that equal or exceed Utah in sheer numbers of rare plant species (McMahan 1987, Shultz 1993). Nearly 25 years have passed since the inventory of rare plant species in Utah began. Rare plant lists have been developed and maintained over this period through the efforts of federal and state agencies (e.g., USDI Fish and Wildlife Service, USDA Forest Service, USDI Bureau of Land Management, Utah Natural Heritage Program); professional botanists (Dr. Stanley L. Welsh

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**Plants and Plant  
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and others at the Brigham Young University herbarium; Dr. Leila M. Shultz at Utah State University); and the Utah Native Plant Society.

Since the federal Endangered Species Act (ESA) was passed in 1973, the US Fish and Wildlife Service (USFWS) has formally listed 23 plant species that occur in Utah as endangered or threatened (including *Arctomecon humilis*, *Asclepias welshii*, *Astragalus montii*, *A. perianus*, *Carex specuicola*, *Cycladenia jonesii*, *Echinocereus engelmannii* var. *purpureus*, *E. triglochidiatus* var. *inermis*, *Erigeron maguirei*, *Glaucocarpum suffrutescens*, *Lepidium barnebyanum*, *Lesquerella tumulosa*, *Pediocactus despainii*, *P. sileri*, *P. winkleri*, *Phacelia argillacea*, *Ranunculus aestivalis*, *Primula maguirei*, *Schoenocrambe argillacea*, *S. barnebyi*, *Sclerocactus glaucus*, *S. wrightiae*, *Spiranthes diluvialis*, and *Townsendia aprica*). Three of these plants (*Astragalus perianus*, *Echinocereus engelmannii* var. *purpureus*, and *E. triglochidiatus* var. *inermis*) have subsequently been delisted for various reasons. In addition, one plant species (*Astragalus desereticus*) has been formally proposed as threatened, but a final rulemaking has not yet been made. The USFWS also currently regards seven plant species as listing candidates in Utah (including, *A. equisolensis*, *A. ampullarioides*, *A. holmgreniorum*, *Castilleja aquariensis*, *Gilia caespitosa*, *Penstemon grahamii*, and *P. scariosus* var. *albifluvis*).

US Forest Service sensitive species policy is defined in Forest Service Manual 2670. The sensitive plant species list in Region 4 was last updated on April 29, 1994, and includes 79 taxa that occur in Utah (Joslin 1994). The Forest Service is currently reviewing its sensitive species policy at the national level (T. Prendusi 1997, pers. comm.), and if any policy changes are made as a result of this review then additions or deletions to the Region 4 sensitive plant list may be necessary. The Forest Service also has a Research Natural Area (RNA) program whereby lands supporting examples of pristine or undisturbed plant communities are designated as reference areas for scientific research. Currently there are 28 RNAs on Forest Service lands in Utah.

US Bureau of Land Management sensitive species policy is set forth in the BLM 6840 manual. On August 28, 1996, the BLM Utah state office adopted an interim sensitive species list that includes 107 plant taxa (Lamb 1996). The interim BLM sensitive plant list will be updated as additional information becomes available.

Existing state laws for protection and management of native plant species and natural vegetation are limited in their scope. For example, there is no mention of these resources in the Wildlife Resources Code (Title 23). Both the School Trust Lands Administration and the Division of Forestry, Fire and State Lands have the authority to protect and manage federally listed threatened or endangered plant species on lands under their jurisdiction if they so choose (Title 53C, Ch. 2, Sec. 202 and Title 65A, Ch. 2, Sec. 3).

In addition, the State's "vegetation materials transport law" provides that removal of forest products or native vegetation is illegal unless written permission from the landowner is obtained (Title 78, Ch. 38, Secs. 4.5 through 4.9). Although originally intended to prevent unauthorized harvest of Christmas trees, this law may provide limited protection for other natural vegetation as well.

The Division's Utah Natural Heritage Program (UTNHP) became part of the Department of Natural Resources in 1990 under a cooperative agreement with The Nature Conservancy. In 1994, the program was transferred to the Division's Habitat Section. Authority for UTNHP exists through a cooperative agreement between the Department and the USFWS under Section 6 of the ESA (i.e., the part of the Act addressing cooperation between the federal government and the states).

Since UTNHP's initial establishment in 1988, the US Bureau of Land Management, US National Park Service, US Fish and Wildlife Service, US Forest Service, Utah Department of Natural Resources, and other organizations have funded projects with UTNHP toward the completion of sensitive plants species inventory and database development. Most recently funding has become available through the Central Utah Project Completion Act for sensitive plant species database development.

The UTNHP functions as a centralized repository for information on threatened, endangered, and sensitive plant and animal (both invertebrate and vertebrate) species in Utah. As a function of its plant inventory and database development, the program responds to requests for rare plant information from a wide variety of government agencies, non-government organizations, and private interests. In addition, the UTNHP participates, through the state's Resource Development Coordinating Committee, in reviews of state and federal actions that may affect rare plants or their habitats. Such responses and reviews are done on a continuous, as-needed basis, and help to minimize or avoid conflicts between rare plant species and development projects and on-going land management activities.

### ***Future in Utah***

In February, 1996, the USFWS changed its policy regarding determination of candidate species for possible future listing under the federal Endangered Species Act (ESA). In so doing, they eliminated the "radar screen" by which various government agencies and non-governmental organizations had been tracking species that are rare, declining, or otherwise tending toward ESA listing. Unless the State in concert with other agencies and organizations effectively moves to perform this function, it will be difficult if not impossible for us to determine which species are most in need of proactive conservation or management. Inventory, conservation, and management activities on behalf of our native plant species and vegetation resources, are not adequate to support this effort.

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**Plants and Plant  
Communities**

The conservation and management of Utah's biological diversity cannot be effectively accomplished if we continue to focus our efforts solely on individual species. After 20 years of experience using the single-species approach, both economic development interests and conservationists agree that a new approach to biological conservation is needed, in which entire ecosystems are managed for their component species while at the same time allowing for compatible human uses. Identification of valuable wetlands and riparian areas, as well as upland habitats, is of critical importance for achieving an ecosystem approach to conservation. However, our current knowledge of the geographic distribution and composition of these habitats is both limited and fragmented. Hence, there is a strong need for a statewide classification and inventory of plant communities. It is important to emphasize that such a plant community inventory would not be "starting from scratch" but instead would be accumulating and building upon a wealth of existing information, most of which has already been considered in preparation of a preliminary statewide vegetation classification (Bourgeron et al. 1993). However, some lower elevation plant communities, including both desert shrublands and wetland and riparian habitat types, are not well represented in the existing classification because they are not yet adequately inventoried and described.

Utah climatology has been studied extensively, and records are available for as far back as 1895 for some weather phenomena. In general, Utah climate is typical for a semi-arid desert biome, with the exception being the northern part of the state which experiences variations caused by the presence of the Great Salt Lake and the Wasatch and Uinta Mountain Ranges.

### ***Typical Conditions and Significant Historic Weather Events***

Utah can have some of the best and some of the worst of the nations weather in both summer and winter and during transitional periods between seasons. When ridges build aloft over the Wasatch Mountains, the weather can be characterized by deep blue skies and brilliant sunshine, cold nights and mild days. When troughs settle in, the state can be hit by very heavy mountain snows with accumulations measured in feet rather than inches.

Historically, weather patterns in Utah, as well as other parts of the country, seldom coincide with a monthly calendar. For instance, winter season neither begins nor ends on 31 December each year. For this reason, historical weather events for Utah are summarized within four periods, Winter (December, January and February), Spring Transition (March, April and May), Summer (June, July and August), and Fall Transition (September, October and November).

*Winter* - Winter in Utah typically sets in during late November or early December. Periods of high winds, bitter cold and large accumulations of snowfall are not uncommon for the state during winter months. Numerous record snowfall amounts, cold temperature, and high wind speeds have been recorded along the Wasatch Front and in other portions of the state during winter. On January 5, 1913, the record low temperature for the state was set at Strawberry Tunnel where the thermometer plunged to 50 degrees below zero.

*Spring Transition* - Late winter and early spring are typically the windiest, wettest, and cloudiest time of year in Utah. Most of the annual precipitation occurs during this time frame, and most of it occurs in the form of snow. Cold troughs that move in from the Pacific Ocean are often separated from the westerly winds and remain stationary or at least move very slowly causing precipitation to linger for days. For example, Salt Lake City recorded 21.6 inches of snow during this period in 1944. When the storms move into the plains, the Pacific moisture can be augmented by moist air originating over the Gulf of Mexico. The result is heavy mountain and windward slope snowfall. In lower elevations, in between storms, the air is mild or even warm as well as dry, and with the typically bright and sunny days, the snow disappears quickly. Melting is much slower in higher elevations where the delayed spring and summer runoff will be the source of water for irrigation and urban area use in the drier months to come. In general, a 50% increase in total water equivalent precipitation occurs in April over March levels. Like the plains states, the Rockies are at or near the annual peak of precipitation in May. Precipitation still falls primarily in the form of snow in the higher elevations but is more likely to result in thundershowers at

## **Physiography and Climate**

*continued*  
**Physiography and Climate**

lower elevations. When moist air is in place, thunderstorms can become almost a daily event. These storms can produce large and often destructive hail as well. In fact, the nation's highest frequency of hail is found in the Rockies during this time of year.

*Summer* - Utah and the Intermountain West settles into a relatively dry pattern during June, although daily shower and thunderstorm activity can be common, especially at higher elevations where upslope flow and differential heating provide favorable conditions for convective current formation. Hail can be common, but snowfall is typically rare. Daytime temperatures can reach into the 90s while nights are pleasantly cool. Most of the Intermountain West nears its second peak in the annual precipitation cycle during July. Daily thunderstorm activity can be common, including the occurrence of hail. Snowfall is at an annual minimum during July, even at the highest elevations. Monsoon flow can cause an increase in thunderstorm activity as moisture travels gradually northward. Snowfall in August is extremely rare, although not unheard of. Otherwise, conditions similar to late June and early July typically prevail in Utah during the month of August.

*Fall Transition* - Most years, the Intermountain West begins a rapid transition from Summer to winter in the early fall. Conditions often oscillate day to day. The heat of summer can be felt one day, and the next morning a strong cold trough can bring mountain snows that may descend to much lower elevations as well. However, just as quickly as snow comes, it usually is gone. As cold troughs lift to the north and east, warm 70 and 80 degree temperatures return as warm, westerly Chinook winds begin to blow. Chinook is a Native American term meaning "snow-eater", and these warm desiccating winds result from the sinking and resulting warming of air that is dry from passage over the mountains. Dramatic temperature and weather changes typically occur from day-to-day during October in Utah.

***Utah Physiographic Region Climate Data Divisions***

The topography of Utah is divided into five physiographic regions (Figure 1). These regions are based on the National Vegetation Classification System developed by a partnership of agencies and non-governmental organizations. The system was developed for the purpose of providing nationwide consistency in naming and describing vegetation types for assessing distribution, importance, and conservation status. In addition, the system allowed for more effective planning and management across jurisdictional boundaries.

*Utah Mountains* - The Utah Mountains physiographic region consists primarily of those habitats and vegetation characteristics associated with the Wasatch Mountains and the Uinta Mountains. The area consists primarily of southern Rocky Mountain steppe habitat, open woodlands, coniferous forests, and alpine and sub-alpine meadows. The region includes approximately one-third of the total land area of Utah and extends from the extreme north portions of the state into deep southern regions.

*Basin and Range* - The Basin and Range physiographic region includes the Great Basin portion of Utah. The entire Bonneville Basin is included in this region as well as the northern portion of the Canyonlands area. The region is characterized as desert and semi-desert habitat and vegetative structure, and encompasses approximately the entire western one-third of the state's land area (Figure 1).

*Colorado Plateau* - The Colorado Plateau physiographic region includes the Uinta Basin and extends from the Uinta Basin south to the Arizona border. The area consists of semi-desert climate and habitat and includes the northern-most portion of the Grand Canyon area and the Navajo Canyonlands area. The Colorado Plateau physiographic region also encompasses approximately one-third of the state's total land area (Figure 1).

*Wyoming Plateau* - Only three relatively small areas in extreme northern and northeastern Utah are representatives of the Wyoming Plateau physiographic region. The area is considered to be semi-desert in climate and habitat characteristics. Two of the three Wyoming Plateau regions occur north of the Uinta Mountains and the third lies in eastern Cache County between the northernmost portions of the Wasatch Front and the western boundary of Wyoming (Figure 1).

*Mojave Desert* - The extreme southwestern portion of Utah consists of semi-desert and desert climate and habitat that is representative of the Mojave Desert physiographic region. The area is part of the tropical/subtropical steppe habitat which occurs in southwestern portions of the United States. The Mojave Desert portion of Utah is bordered by three of the remaining four physiographic regions, Basin and Range, Uinta Mountains, and Colorado Plateau (Figure 1).

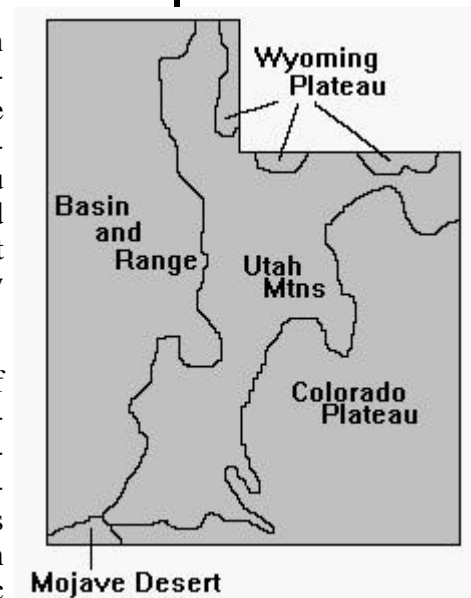


Figure 1. Utah Physiographic Regions

Utah is divided into 7 climate divisions which overlap with each of the physiographic regions mentioned above (Figure 2). Climate Division 1 includes the entire Basin and Range physiographic region. Climate Division 2 includes the Mojave Desert physiographic region of Utah in the extreme southwestern portion of the state. Climate Division 7 includes the entire Colorado Plateau physiographic region. Climate Divisions 3 through 6 occur within the Utah Mountains physiographic region. Part of Division 5, north of the Uinta Mountains and West of Cache Valley, contains portions of the Wyoming Plateau physiographic region, which differs physiographically but not substantially climatically from the remainder of the division.

Each climate division within Utah contains several data collection stations. For this report, Division 1 climate data were analyzed for the Beaver collection, for Division 2 St. George climate data, for Division 3 Salt Lake City climate data, for Division 4 Richfield climate data, for Division 5 Logan climate data, for Division 6 Vernal



*continued*  
**Physiography and Climate**

climate data, and for Division 7 Moab climate data. Data for annual precipitation, max/min temperature, relative humidity, snowfall and additional climate variables are recorded regularly at each data collection station, and some records are available for as far back as 1895.

***Temperature, Precipitation and Drought***

Temperature, precipitation, and drought were calculated for Utah from monthly averages recorded within each climate division. Two periods were used for examination of data, 1977-1986 and 1987-1996. Data for 1997 were not included due to an incomplete analysis of weather records for that year being available. Temperature and precipitation patterns for both periods were mostly typical overall, with some variation in precipitation between climate divisions. Drought patterns varied substantially between the two periods, with the 1977-1986 period generally being more moist overall in Utah and the 1987-1996 period being considerably dry. Monthly averages for each period indicate a relatively long-term drought condition as persisted in several portions of the state during the past 20 year period.

*Temperature* - The extremely varied topography of Utah results in varying conditions in most climate variables, including temperature. Monthly high and low temperature averages within each climate division were calculated for Utah for the period 1977-1996.

Maximum and minimum-recorded temperatures vary within the state from region to region as well as seasonally. Average monthly temperatures for all climate divisions were used to calculate an average statewide monthly temperature for the periods 1977-1986 and 1987-1996 (Figure 3), indicating that monthly average temperature for the state has not varied substantially in the past 20 years. March, April, May and October average temperatures were approximately 1.3 - 2.2°F warmer during 1977-1986 than more recently, while December average temperature has been approximately 1.5°F warmer during 1987-1996 than during the previous ten-year period.

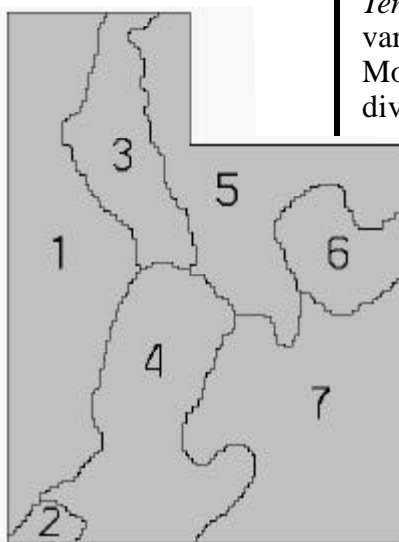


Figure 2. Utah Climate Divisions

Available data on the average, typical, and record temperatures for each Utah Climate Division are given in Table 1. While several temperature measuring stations do occur within each climate division, the temperatures presented in Table 1 are values recorded at representative stations within each climate division rather than an average of all measuring stations where data were available (see Table 1). In general, Climate Division 6 (Uinta Basin) has the coolest annual temperature while Climate Division 2 (St. George) has the warmest temperature in the state. Temperatures in division 6 are typically cooler year round, with the exception of Climate Division 5 (Logan) which averages slightly cooler in the summer months. Otherwise, the remaining climate divisions for Utah have typical and seasonal temperatures that are quite similar based on the calculated twenty-year averages (Table 1). In addition, the average high temperature for Climate Division 2 (St. George)

was approximately 80-82°F for the period 1977-1986 and 79-81°F for the period 1987-1996, a difference of approximately 1°F.

The average low temperature for the region was also approximately 1°F cooler 1977-1986 than during more recent times. In contrast, December average temperature for Climate Division 4 (Richfield) has averaged approximately 2°F warmer during 1987-1996 than during 1977-1986. For Climate Division 7 (Moab) the December temperature has averaged approximately 3°F cooler the past 10 years (28°F) than during 1977-1986 (31°F).

*Precipitation* - Average annual precipitation in Utah ranges from a low of less than 8 inches per year to a high of over 50 inches per year. Most of the high precipitation readings are recorded in the mountainous portions of the state, especially in the High Uintas. Well over two-thirds of the state receives less than 12 inches of total precipitation on an annual basis (Figure 4).

Average precipitation for the past twenty years was calculated for each climate division. Overall, the 1977-1986 period received higher precipitation than was recorded for 1987-1996 (Figure 5). As would be expected, the summer months typically represent the lowest precipitation periods statewide within each climate division.

Higher precipitation amounts observed for the 1977-1986 time period are partly due to the higher than average amounts recorded during 1982-1983. In addition, average precipitation amounts and overall patterns for the past 20 years show some similarities between climate divisions. Climate Divisions 2 and 3 are quite similar in precipitation amounts and patterns; likewise Climate Divisions 1, 6, and 7 are similar, and Climate Divisions 4 and 5 as well (Figure 5). On this basis, some management benefits could be derived from dividing the state up into three regions based on precipitation patterns instead of dealing with each area or climate division on an individual basis.

*Climate Division 1* - Mean annual precipitation for Climate Division 1 is recorded at 8.85 inches. Highest amounts typically occur in the spring season when the average annual precipitation is 2.7 inches. Average snowfall for the area is 19.9 inches, and summer rainfall amounts average 2.01 inches. Annual spring and fall season precipitation is 2.70 and 2.15 inches, respectively, and an average of 12.4

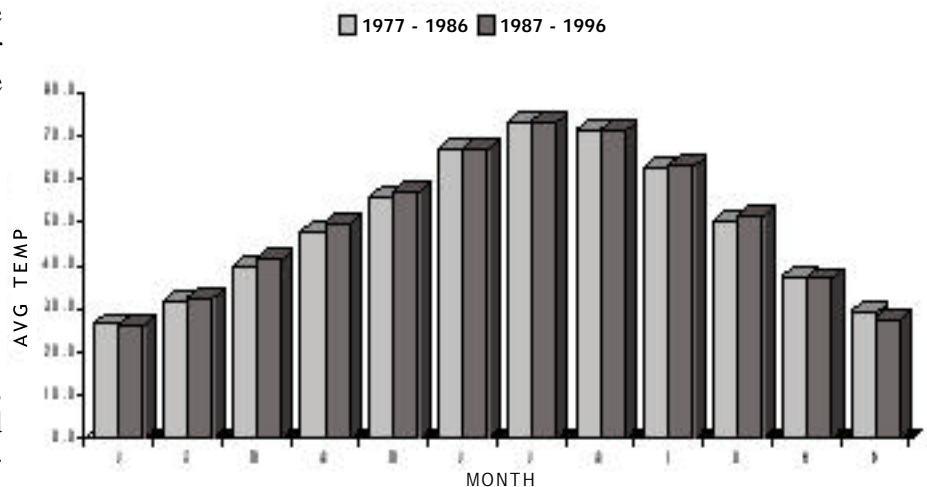


Figure 3. Monthly average temperature (F°) comparison for the State of Utah for the period 1977-1986 and 1987-1996. Average temperature was calculated by aggregating monthly temperature values for each Climate Division, and then dividing by the number of divisions statewide

## Physiography and Climate

*continued*

inches of snowfall annually occurs during the spring season for the area. For the period 1977-1986, precipitation averaged between 0.5

Table 1. Temperature data for Utah by climate division.

Climate Division	Average Temp (°F)					Typical Temp (°F)		Record Temp (°F)	
	Annual	Winter	Spring	Summer	Fall	Dec-Jan	Jul-Aug	Winter	Summer
1 (Beaver)	49.2	28.4	47.8	70.7	50.0	25 28	72 73	-35	105
2 (St. George)	61.9	42.3	60.9	82.0	62.3	N/A	79-81	-11	117
3 (Salt Lake)	51.9	30.9	50.2	73.9	52.7	26 (Dec)	73 (Jul)	-22	107
4 (Richfield)	48.9	30.1	47.8	68.3	49.6	27 (Dec)	69 (Jul)	-33	104
5 (Logan)	48.2	26.5	46.9	69.8	49.6	21 (Jan)	65 (Jul)	-23	102
6 (Vernal)	45.1	20.3	45.8	67.6	46.6	17	71 (Jul)	-38	103
7 (Moab)	56.4	33.8	56.8	78.4	46	28(Dec)	75(Jul)	-24	114

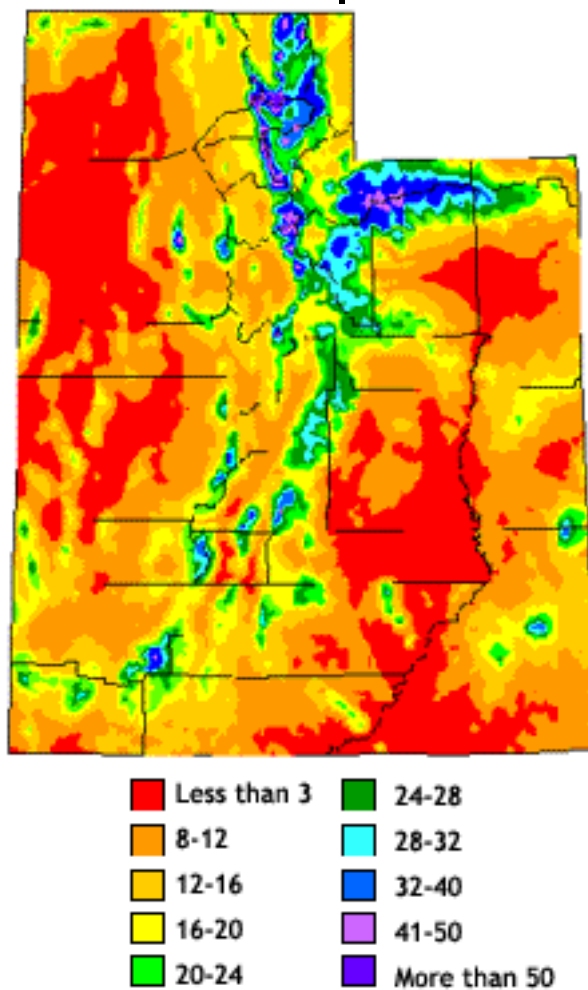


Figure 4. Average annual precipitation patterns for the State of Utah. Measured in inches.

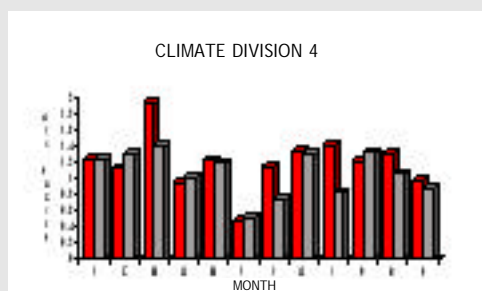
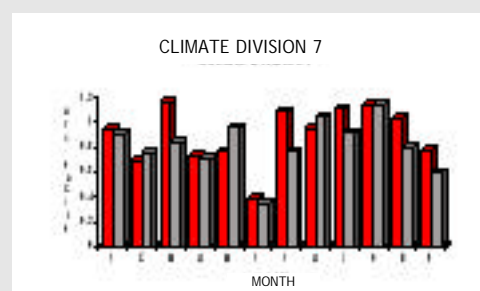
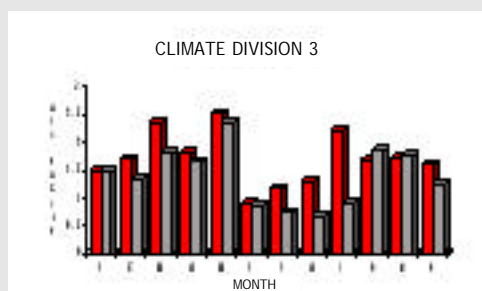
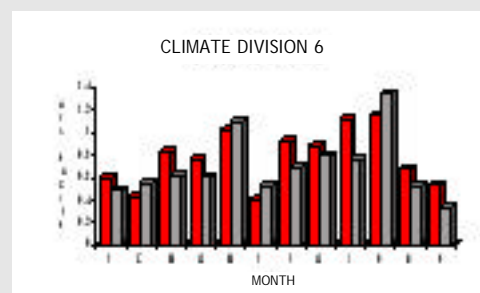
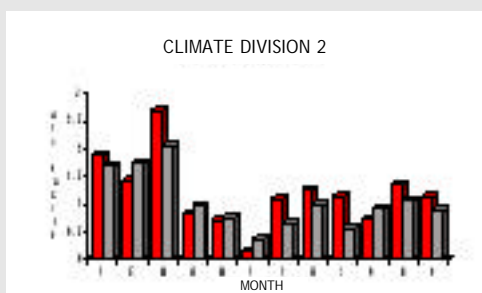
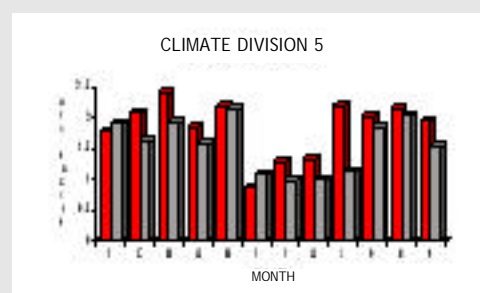
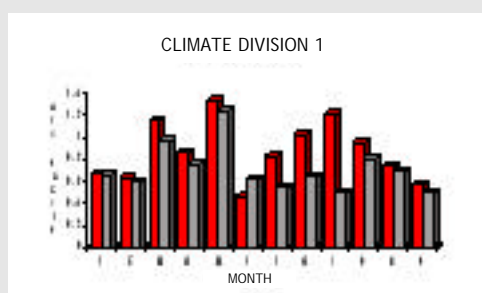
and 1.0 inches, with peak periods occurring typically in spring and fall (Figure 5).

*Climate Division 2* - Most of Climate Division 2 receives only 8 inches of precipitation or less on an annual basis. Highest amounts occur in late-winter and averages 2.94 inches annually. Average annual snowfall is also low at 2.6 inches. Spring, summer, and fall amounts average less than 2 inches, and annual snowfall in the area during these periods is 0.1 inches or less. March is typically the wettest month of the year in the area and June the driest based on averages calculated for the past 20 years.(Figure 5).

*Climate Division 3* - Mean annual precipitation for Climate Division 3 is the second highest recorded for the state, outside the Uinta Mountains (Figures 5). Average annual precipitation for the area is 15.71 inches. Highest amounts occur in the spring season when the average annual precipitation is 5.6 inches, and average snowfall for the area is 63.3 inches. Winter snowfall averages 37.7 inches, and spring snowfall annually averages 16.7 inches. Spring rains average 5.67 inches annually for the area, with summer and early fall typically being the driest periods of the year (Figure 5).

*Climate Division 4* - Portions of Climate Division 4 receive up to 40-50 inches of precipitation annually, although the annual average for the area is recorded at 8.29 inches.

Annual spring, summer, and fall precipitation amounts are very sim-



*Figure 5. Monthly average precipitation comparison for the State of Utah for the period 1977-1986 (dark bars) and 1987-1996 (light bars). Monthly averages were calculated using monthly precipitation values for each Climate Division statewide.*

*continued*  
**Physiography and Climate**

ilar, and winter snowfall averages 12.5 inches each year. Summer snowfall has not been recorded in most portions of the area for the past 28 years. June is typically the driest month within Climate Division 4 (Figure 5).

*Climate Division 5* - Highest annual average precipitation for Utah occurs in Climate Division 5. Overall annual average precipitation is 18.0 inches, and annual winter snowfall is 39.3 inches. Spring precipitation averages 6.04 inches each year, and spring snowfall amounts averages 14.7 inches. Even fall precipitation amounts are relatively high compared to most of the state (Figure 5), with an average annual amount of 4.54 inches and 8.7 inches of snowfall.

*Climate Division 6* - Climate Division 6 in the Uinta Basin also records low annual precipitation typically with an average of 8.18 inches. Most of the area receives considerably less than the annual average, however, and spring precipitation amounts are typically the lowest for the state and are typically comparable to precipitation recorded in Climate Division 1 (Figure 5). Fall and spring periods record the highest seasonal averages at 2.38 and 2.33 inches, respectively, each year. Summer snowfall has not been recorded in the region for the past 28 years, whereas mean annual winter snowfall is recorded at 12.2 inches.

*Climate Division 7* - Climate Division 7 comprising the southeastern portion of Utah also records relatively low annual precipitation amounts with an annual average of 8.64 inches. Precipitation averages are very similar to those for Division 6, with the exception of winter snowfall where annual amounts average only 5.3 inches.

*Drought* - Drought is measured in Utah on a monthly basis. The Palmer Drought Severity Index (PDSI) was used for calculating drought history in Utah for the period 1977-1986 and from 1987-1996. The PDSI index is a monthly value that is generated indicating the severity of a wet or dry period. The PDSI is based on the principles of a balance between moisture supply and demand. Man-made changes are not considered in the calculations. The index generally ranges from -6 to +6, with negative values denoting dry periods and positive values indicating wet periods. PDSI values of 0 to -0.5 = normal conditions; values of -0.5 to -1.0 = incipient drought; values of -1.0 to -2.0 = mild drought; values of -2.0 to -3.0 = moderate drought; -3.4 to -4.0 = severe drought; and values greater than -4.0 = extreme drought. There are a few records for Utah that equal or exceed a -7 or +7 value.

A substantial difference in drought conditions have occurred within Utah over the past 20 years (Figure 6). In general, most regions of the state were not in drought conditions during 1977-1986. During that time period, fall periods were typically the wettest periods in the annual cycle for all climate divisions (Figure 5). Drier periods typically occurred during the summer period, with the exception of winter PDSI values for Climate Divisions 1 and 6(Figure 6).

In contrast, conditions during the 1987-1996 period have been at incipient drought levels or below statewide. Overall, the state has been at incipient to mild drought conditions during the past 10 years. The driest area for the state during that period has been Climate Division 1. In contrast, Climate Division 7 has only experienced very low-level drought conditions annually during the past 10 years.

*Climate Division 1* - Climate Division 1 has been at mild to moderate drought conditions for the past 10 years. The most severe drought conditions typically occur in late summer and early fall (Figure 6). The most dramatic change in the area over the past 20 years has occurred in late summer and early fall, mostly due to precipitation recorded during portions of 1981 and 1982. Total precipitation for the area during October 1981 was 2.27 inches and for September 1982 was 4.16 inches. In contrast, precipitation amounts for Climate Division 1 have monthly been below 2 inches for the past 10 years, with the exception of May 1985 when 2.67 inches were recorded.

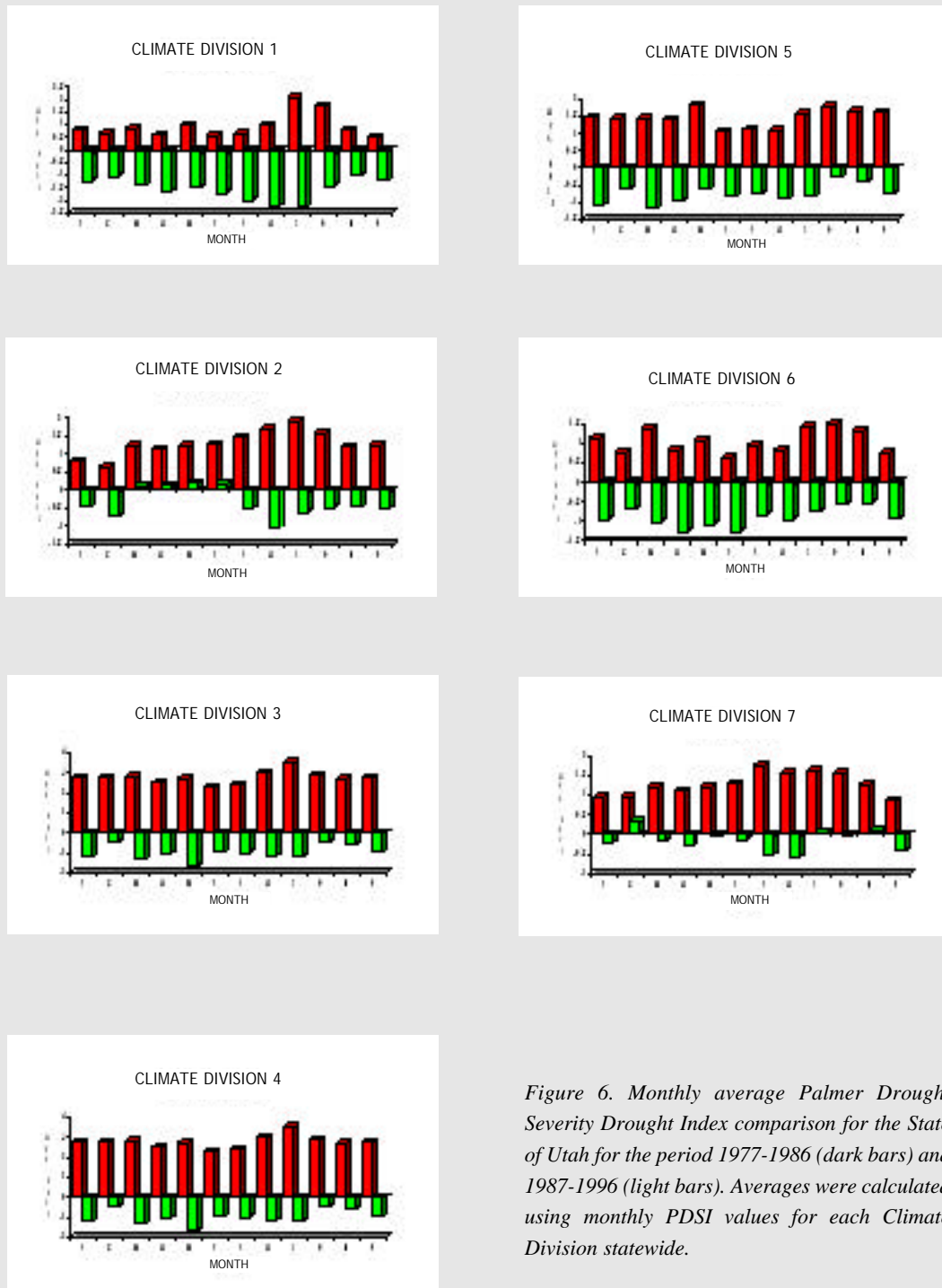
*Climate Division 2* - Interestingly, Climate Division 2 has only experienced incipient drought conditions during the past 10 years from late summer into late winter (Figure 6). Typically the area receives its highest precipitation amounts in early spring (Figure 5), which accounts in part for the area not experiencing drought conditions during summer during the past 10 years (Figures 5 and 6). However, substantial differences in drought conditions have been observed during late summer and early fall over the past 20 year period (Figure 6).

*Climate Division 3* - Climate Division 3 has experienced incipient to mild drought conditions over the past 10 years (Figure 6). The months of October and November have been in the best conditions during that time period, and precipitation amounts for these two months have been higher over the past 10 years than previously recorded (Figure 5). Overall drought conditions for the region are comparable to conditions observed in Climate Division 5 (Figure 6).

*Climate Division 4* - Incipient to mild drought conditions have persisted within Climate Division 4 for the past 10 years with the exception of the month of August (Figure 5). In fact, drought conditions for the area during August have not been recorded for the past 20 years. Only during the three years since 1986 have August precipitation amounts in the area been below 1.3 inches. During 1990, August precipitation recorded for the area was 0.77 inches, for 1995 the amount was 0.94 inches, and for 1996 precipitation recorded for the area was 0.43 inches.

*Climate Divisions 5 and 6* - Drought conditions in both Climate Divisions 5 and 6 have been very consistent for the past 20 years (Figure 6). The most severe drought conditions typically occur in late spring and summer, and fall drought conditions are considerably reduced than during other times of the year. Overall, however, drought conditions during the past 20 years have been less severe in Climate Division 5 than 6 (Figure 6).

*continued*  
**Physiography and Climate**



*Figure 6. Monthly average Palmer Drought Severity Index comparison for the State of Utah for the period 1977-1986 (dark bars) and 1987-1996 (light bars). Averages were calculated using monthly PDSI values for each Climate Division statewide.*

*Climate Division 7* - Statewide, Climate Division 7 has experienced the least severe drought conditions during the past 20 years (Figure 6). The most severe drought conditions typically occur in July and August in the area, but only incipient drought conditions have been recorded. In fact, the months of September, October, and November have not experienced drought conditions at all during the past 20 years (Figure 6).

### ***El Nino Phenomena***

Much interest has been directed recently toward the weather patterns known as El Nino. El Nino is a disruption of the ocean-atmosphere system in the tropical Pacific having important consequences for weather around the globe. Among these consequences are increased rainfall across the southern tier of the US and in Peru, which has caused destructive flooding, and drought in the west Pacific, sometimes associated with devastating brush fires in Australia. Observations of conditions in the tropical Pacific are considered essential for the prediction of short-term (a few months to 1 year) climate variations. In fact, drought conditions are considered the most significant predictable feature of El Nino years. To provide necessary data, the National Oceanic and Atmospheric Administration (NOAA) operates a network of buoys which measure temperature, currents and winds in the equatorial band. These buoys daily transmit data which are available to researchers and forecasters around the world in real time.

In normal, non-El Nino conditions, the trade winds (easterlies) blow toward the west across the tropical Pacific. These winds pile up warm surface water in the west Pacific, so that the sea surface is about 1/2 meter higher at Indonesia than at Ecuador. The sea surface temperature is about 8 degrees C higher in the west, with cool temperatures off South America, due to an upwelling of cold water from deeper levels. This cold water is nutrient-rich, supporting high levels of primary productivity, diverse marine ecosystems, and major fisheries. Rainfall is found in rising air over the warmest water, and the east Pacific is relatively dry. The observations at 110° W show that the cool water (below about 17° C) is within 50m of the surface.

During El Nino, the trade winds relax in the central and western Pacific leading to a depression of the thermocline in the eastern Pacific, and an elevation of the thermocline in the west. (La Nina is an opposite phenomena which is less common but characterized by much colder than normal water along the west coasts.)

El Nino reduces the efficiency of upwelling to cool the surface and cuts off the supply of nutrient rich thermocline water to the euphotic zone. The result is a rise in sea surface temperature and a drastic decline in primary productivity, the latter of which adversely affects higher trophic levels of the food chain, including commercial fisheries in this region. Rainfall follows the warm water eastward, with associated flooding in Peru and drought in Indonesia and Australia. The eastward displacement of the atmospheric heat source overlaying the warmest water results in large changes in the global atmos-



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**Physiography and Climate**

pheric circulation, which in turn force changes in weather in regions far removed from the tropical Pacific.

During a normal year, the jet stream typically splits over the Pacific Ocean at approximately 30,000 feet above sea level. The stronger airflow occurs over the northern branch of the jet stream, and storms enter the United States from the northwest following the northern split. The southwestern portion of the United States is typically dry. During an El Nino year, the stronger airflow occurs over the southern branch of the jet stream. Storms enter the United States from the southwest and follow the southern branch. The southwest experiences wetter than normal conditions, and the southern branch of the jet stream split also brings in Gulf moisture which further intensifies wet conditions.

An El Nino can begin and end in any month and typically lasts for approximately 12-18 months. Intensity varies by year. El Nino effects in Utah are not predictable. Generally, southwestern Utah has more summer precipitation than normal in El Nino years. Snowfall, however, is not predictable. For example, the last six moderate to strong El Nino periods have experienced higher than normal snowfall and others lower than normal snowfall. El Nino weather patterns have occurred in rapid successions during 1990-1994, which is unusual. El Nino weather events are typically more periodic and less severe overall than those observed during the past few years.

### **Range**

Unquestionably, most of the desert vegetation of Utah has undergone significant transformation during the time since settlement with respect to quality and quantity of vegetation due to livestock grazing. Many sources of evidence point unmistakably to the fact that tremendous areas of the Bonneville Basin foothills, formerly occupied by native species of bunch grasses, have given way almost entirely to desert shrubs and junipers resulting in substantial changes in ecosystem dynamics.

Perennial grasses in the temperate deserts have to initiate growth from basal buds in the early spring. The new growth quickly produces enough photosynthetic surfaces to provide adequate carbohydrates both to compensate for the growth and to replenish the storage reserve for another growth cycle. Flowering and seed production also occur during the spring-early summer growing period, putting additional stress on the physiological system of the plants.

Intensive early spring grazing initially inhibits flowering and seed production and eventually leads to the death of the perennial grasses. In contrast, the woody plants with persistent leaves, such as big sagebrush, do not have to renew their entire photosynthetic surfaces in the spring. This landscape-dominant species of shrubs flower in the fall.

Reduction and eventual near removal of herbaceous vegetation in big sagebrush areas resulted in an increase in density of the dominant shrub species. Of more lasting significance, the reduction in herbaceous vegetation reduced or eliminated the occurrence and spread of wildfires. Wildfire was the method of stand renewal in the pristine big sagebrush communities. Big sagebrush does not sprout after the aerial portion of the plant is consumed by burning.

The biological near vacuum created by over utilization of the herbaceous species on sagebrush rangelands was not maintained. A host of alien herbaceous species were accidentally introduced, and several species proved highly adapted. Russian thistle was perhaps the first of these to become widespread in disturbed habitats. Numerous introductions followed Russian thistle, with cheatgrass becoming the seral dominant of vast landscapes.

The paramount ecological issue concerning the success of alien annual species in Utah is their dominance of plant succession on disturbed habitats. The alien species influence subsequent succession through seedling competition and changing wildfire frequency and timing. Starting with Russian thistle and eventually culminating in cheatgrass, the alien species have pre-empted secondary succession in many plant communities.

Cheatgrass dominance essentially closes plant communities to the establishment of seedlings of native or exotic perennial grass species. The alien species form a seral continuum that assures occupancy of the site by the alien species. Suppress cheatgrass by

## **Wildlife Habitat**

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excessive grazing and tumble mustard will occupy the site. Further intense disturbance will lead to dominance by Russian thistle. Relax the disturbance and succession will proceed to dominance by cheatgrass. Minimal disturbance perpetuates cheatgrass dominance. During the past two decades, cheatgrass has greatly increased in abundance — possibly as a result of the implementation of grazing management systems. Although remnant stands of perennial grasses may benefit from this type of grazing management, cheatgrass also increases.

Annual-dominated plant communities are open to invasion by seedlings of other colonizing species. The spread of halogeton in communities formerly dominated by Russian thistle and in turn the partial displacement of halogeton by barbedwire Russian thistle are examples of this process. The replacement of cheatgrass by medusahead is an example of an alien annual grass that is a forage species being replaced by another alien annual grass that will not support grazing animals. There is real concern that noxious species of *Centaurea* or *Euphorbia* will come to dominate extensive areas in the Great Basin as they have in the Columbia Basin. Perhaps the noxious species adapted to the drier portions of the Great Basin have not yet been introduced from the storehouse of species that exist in such genera as *Salsola* in Central Asia. As a measure of how disruptive such a species could be to the livestock industry and the environment in general, consider how halogeton contributed to the virtual extinction of the range sheep industry in many areas of the Great Basin.

The sagebrush-dominated ranges of Utah today are in the best condition they have been during this century, and all indications are that the century will close with a decade of well-documented environmental restoration. How can this be, with the numerous environmental disasters associated with livestock? Livestock numbers are much lower than earlier in the century. The range sheep industry has virtually disappeared because of problems with predation, plant poisoning, and labor. More importantly, every piece of public-administered rangeland is subject to some form of grazing management based on principles of plant ecology.

***Forests***

Aspen communities provide the following ecosystem values: rich biodiversity, luxuriant undergrowth, excellent watershed protection, important water yields, favored wildlife habitat, and wood fiber production. Aspen communities are second only to riparian areas in species diversity and abundance.

For millennia functioning aspen communities in the West regenerated as clones with suckers arising from parent root systems that survived frequent wildfires. The absence of fires on these landscapes, coupled with excessive browsing of young aspen trees, has led to rapid displacement of aspen communities by conifer forests throughout Utah.

Recent data from a systematic, state-wide survey of all Utah woodlands and forests provide a baseline to estimate the magnitude of ecosystem values forfeited. In Utah, about 2.9 million acres of forested lands have aspen trees present. However, about 1.4 million of these forests have aspen as the dominant tree species. The other 1.5 million acres are now classified as conifer forests. Conifer trees transpire more water than aspen and have sparse undergrowth with relatively few species. Conifer forests have displaced more than 50% of the aspen communities in Utah since European settlement. This displacement could cause the annual forfeiture of 375,000 acre feet of water that would have been available for streamflow and the annual loss of 750,000 tons of undergrowth biomass production in the mountains of Utah.

### ***Wetlands and Riparian Habitat***

Wetlands and riparian areas comprise <1% of the land area in the western US, yet they support a tremendous diversity and abundance of wildlife. In Utah at least 80% of all animals use riparian areas at some stage of their lives. An inventory of wetland and riparian habitat does not exist in Utah. This makes it impossible to accurately determine what the long term loss is and to project what the future may hold for many wildlife species dependent on these habitats. However, based on studies conducted in Arizona and New Mexico, it's safe to speculate that between 80-95% of our native riparian habitat has been lost or altered in the last 150 years.

On the basis of unpublished US Department Of Agriculture records it was estimated that 244,000 acres of Utah's wetlands had been lost from the 1780s to the 1980s, apparently from agricultural drainage alone. Also, large-scale water-development projects have resulted in losses of wetland habitat. According to records filed with the Utah Division of Water Rights, at least 1,600 dams have been constructed in Utah since the mid-1800s. Of these dams, 445 impound 20 acre-feet of water or more. Impounded water provides some wetland habitat but might not compensate for wetlands lost to dam construction, rising waters in reservoirs, or receding rivers. Because of dam construction, less than 10 percent of the original riparian area (uplands and wetlands associated with unimpounded water bodies) along the Colorado River still exists. The US Fish and Wildlife Service has estimated that 50-60% of wetlands in Utah have been lost. Expansion of agricultural areas, encroachment of residential developments, industrial growth, mining, ski-area development, and grazing also have resulted in wetland losses.

### ***Other***

Demand for residential and commercial land has consumed agricultural land at an increasingly rapid pace. In 1992, agricultural land in Salt Lake and Davis Counties occupied less than half the acreage it occupied in 1974.

Rapid urban expansion is projected to continue over the next 20 years, filling in much of the remaining vacant land along the

*continued*  
**Wildlife Habitat**

Wasatch Front. Of the existing 488,760 acres of agricultural land in the Greater Wasatch Area, urban development is projected to consume 65,610 acres by the year 2020.

Currently, no coordinated regional or statewide effort exists to preserve agricultural lands.

Given the combination of demographics and the estate tax, many acres of open space, wildlife habitat, farmland, ranch land and watersheds are at risk.

An enormous amount of private land in Utah is owned by people who are 60 years old or older. Over the next 15-20 years that property is going to change hands and potentially change use, depending on how landowners plan for the lands' future.

Land, especially close to urban areas, has become so valuable it may have to be sold by the heirs to pay the estate tax.

Maintaining big game populations at levels sufficient to produce huntable populations and supply sufficient revenue to maintain wildlife management operations depends on private agricultural lands.

Seventy-five percent of angling occurs on reservoirs. Most of the reservoirs in Utah are controlled by water conservancy districts, water users, or irrigation companies. Are we working cooperatively to insure continued angling? Are efforts being made to explore water quality issues, reservoir management, flow releases, and the impacts to fisheries? With increased demands being placed on our water resources, what does the future hold for fisheries and what are we doing to address those future demands?

Development of natural resources is a complex issue, since their management and development can conflict with wildlife, water, forests, range, agriculture, outdoor recreation and scenic vistas, and mineral resources. The appropriate development of Utah's many natural resources requires proper planning, which must include measures to avoid, minimize or mitigate for impacts to the environment. A driving factor in natural resource development has been accelerated human population growth in Utah for several decades. Nearly two million people live in Utah today, most concentrated along Utah's Wasatch Front. The remainder of the state, other than a handful of small urban centers, is rural or unpopulated. In addition, a growing economy with a diversity of industries, and an overall low unemployment rate are factors in the rate of natural resource development.

Urbanization results from human population growth and is a term reflective of people becoming city or town dwellers rather than living in a rural setting. Population growth in Utah, although somewhat accelerated by immigration, is primarily caused by natality. This growth continues to enlarge cities and towns, including development of subdivisions in areas heretofore considered rural or uninhabited. Urbanization results in municipal and industrial expansions, road construction, and recreational housing developments of which many become year-long residences. All urbanization results in a growing pressure for development of Utah's natural resources, some of which are discussed below (water and range are dealt with in separate sections).

### ***Forest Resources***

Utah has never been recognized as a significant timber production state. Harvest of bug-damaged timber on a National Forest-by-National Forest basis continues to show small spurts of local activity. The long term trend for timber harvest in Utah is declining on federal lands, due in part to concerns from environmentalists. It is believed that since the listing of the Mexican Spotted Owl under the Endangered Species Act, harvest of timber resources on private lands in Utah has increased due to National Environmental Policy Act restraints for harvest on federal lands. The Utah Division of Forestry, Fire & State Lands has no records documenting the level of timber harvest on private lands.

### ***Scenic and Outdoor Recreation***

Utah's scenic wonders are well known and residents and visitors alike cherish Utah's outdoor recreation opportunities. As indices to this situation, Utah Division of Parks & Recreation operates 45 state parks, which experienced 6,943,780 visitors in 1998. That is a 37% increase over the visitation level of just a decade ago. In 1999 seven state parks that were officially designated as museums which augments the historic nature of some of these unique state legacy sites including Anasazi State Park Museum, Camp- Floyd - Stagecoach Inn State Park and Museum, Edge of the Cedars State Park Museum, Fremont Indian State Park and Museum, Iron

## **Natural Resource Development**

*continued*  
**Natural Resource  
Development**

Mission State Park Museum, Territorial Statehouse State Park Museum, and the Utah Field house of Natural History State Park Museum. Facilities and back country areas at Utah's National Parks and Monuments, National Forests and Public Domain also show an increasing visitation trend.

***Mineral Resources***

Utah's diverse mineral resource includes locateable (e.g., gold, silver, uranium), leaseable (e.g., oil and gas, coal, potash), and saleable (e.g., sand, gravel, quarry rock) minerals. Market conditions dictate production of these resources. For example, consistent production continues from the world famous Kennecott Copper Mine, which produces not only copper, but a substantial amount of gold. The Great Salt Lake continues to yield salt minerals from solar evaporation fields. Southeastern Utah's coal mining industry, which is 12th largest in the nation, shows a solid foothold with 25 million tons per year of production. Oil and gas production from the over thrust belt, which extends full length along the east side of the state continues making Utah the 10th largest producer in the nation. Potash is produced in the Moab area from the nation's only combined solution mining/solar evaporation industry. Southern Utah, primarily the southeastern area, harbors 250 historic uranium mines, where substantial potential for that industry to again boom if world market conditions for nuclear fuels improve. Tar sands remain undeveloped as a sleeping giant on eastern Utah's Tavaputs Plateau as does geothermal energy resources in south-central Utah.

***Agricultural Resources***

Utah's agricultural resources remain important to the state, although urban sprawl continues to compromise farmland. Agricultural exports, particularly to foreign markets have remained at record highs across the last five years. Initiatives to protect farmland are evident with The Nature Conservancy's purchase of the Dugout Ranch in Southeastern Utah and the Utah Open Lands Trust purchase of the Wheadon farm in Draper. These efforts were further emphasized with the first ever debate in the 1997 legislative session of an initiative to generate funds to acquire development rights on farmlands. Although the initiative failed, it signals a recognition for the continued importance of agricultural lands in Utah.

### **Introduction**

Lake, stream, and wetland ecosystems are functioning entities of the hydrologic cycle and as such are important habitats to aquatic and terrestrial wildlife species.

People are also dependent on water, and have altered the natural hydrologic cycle by damming up streams and rivers to capture runoff, whether it be from snow melt or rainfall, in reservoirs. This is done to deliver summer irrigation water to diversion/canal systems, or for municipal or other designated beneficial uses. The result of this damming frequently causes the complete drying up of streams. Altering the natural hydrograph often deprives the stream channel of maintenance flows, impacts the floodplain, riparian and wetland areas, creates erosion and down cutting problems, impacts fish populations, etc. Trans-basin diversions (i.e., diverting water from one drainage basin to another) ‘rob’ one drainage basin of stream flows to deliver that water by canals, tunnels and pipelines for use in another basin. This results in dewatered streams on the one hand, and in some instances abnormally high damaging flows in the receiving stream.

The Utah Division of Wildlife Resources (DWR) uses water for irrigation of wildlife and waterfowl management areas and fish production in state fish hatchery facilities. “Instream flows” in rivers and streams, and “conservation pools” (C-pools) in reservoirs are sometimes acquired to protect fish populations and their habitat.

### **Water Law**

Utah’s water law follows the *doctrine of prior appropriation* (“first in time, first in right”) and allows water to be diverted from streams only for recognized “beneficial uses” of the water. Prior to 1986, the only “beneficial uses” of water recognized by the State Engineer were domestic, irrigation, stock watering, and other uses. Utah law does not require that a specific amount of water has to remain in a stream or river to provide habitat for fish and wildlife; if a prior water right uses the water “beneficially” elsewhere.

The use of water as “Instream flow” (a designated flow which must be allowed to flow down a stream channel) was first introduced (unsuccessfully) to the State Legislature in 1983. It became recognized as a beneficial use of water when it was successfully passed, with many reservations and conditions, by the 1986 Legislature. The DWR was the only entity which could legally use water as an instream flow. In 1996, the State Legislature amended Section 73-3-3 of the Utah Code Annotated, to allow the DWR and the Division of Parks and Recreation to file applications with the State Engineer for permanent or temporary changes for the purpose of providing water for instream flows, within a designated section of a natural or altered stream channel...for:

- i) the propagation of fish
- ii) public recreation

## **Water and Water Use**



*continued*  
**Water and Water Use**

iii) the reasonable preservation or enhancement of the natural stream environment.”

This legislation is a great step towards protecting aquatic habitat for fish and wildlife. However, this law also states that these two Divisions may “

- (i) purchase water rights for the purposes provided in Subsection (a) *only with funds specifically appropriated by the Legislature for water rights purchases*; or
- (ii) accept a donated water right without legislative approval.”

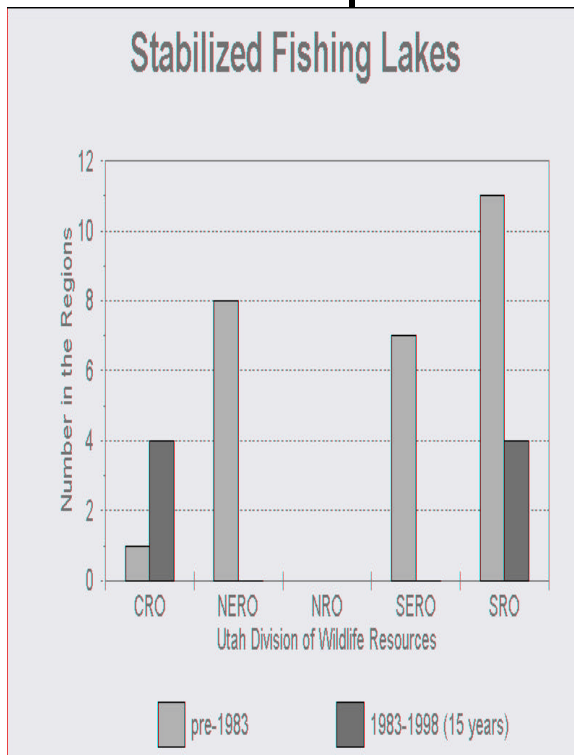


Figure 1. Numbers of stabilized fishing lakes by region

Change applications for instream flows may be filed by either Division on

- (i) perfected water rights already owned by the respective Division,
- (ii) perfected water rights acquired for instream flows, or
- (iii) on water rights appurtenant to acquired real property.

**Historical Situation**

The distribution of water for agriculture and culinary use has been important since the pioneers came to Utah, and remains important to this day. Storage dams were built to hold spring runoff water which was to be released later during the crop growing season. Unless there were downstream water users, these dams often stored all the winter stream flows and dried up the stream through the winter. Diversion dams were built on streams to divert water to canal systems for distributing the water for use away from the streams. When flows are low during the summer, diversion dams often de-water the stream below the diversion. Impacts to stream and riparian habitats have also occurred due to other land use practices,

including grazing, flood control, development, road construction, dam maintenance, etc. Losses of stream habitat were of secondary concern; lives, life styles and economical aspects of water were (and still are) of primary concern.

Stream habitats are of course, impacted by the absence of water. De-watering often occurs below irrigation diversions during the summer, but also occurs below storage reservoirs during the winter, when water is being stored and not released downstream. Under certain circumstances, water users could legally divert all the water out of a stream, and the DWR could not mandate or keep water in a stream channel for fish or wildlife purposes. Fish and other aquatic species become stranded and die when streams are de-watered. Fish reproduction can also be impacted if eggs and fry are in the de-watered stream.

Streams can also be impacted by too much water, when high irrigation flows are released from storage reservoirs into a stream channel for a prolonged irrigation season. The high flows cause stream-bank and stream bed erosion, and prevent or impair recruitment of riparian plant species along the banks. Often spawning substrates are washed out of the system and/or fine sediments are deposited downstream in other habitat.

In reservoirs, when water is released during the summer for irrigation uses, water levels recede quickly, and the decreasing water levels prevent the establishment of important littoral vegetation for fish and invertebrate habitat. During drought conditions, or during normal operations of smaller reservoirs, reservoir basins may be drawn down to minimum or no storage levels, thereby severely impacting reservoir fish populations.

Although diversion practices de-water natural habitats, inefficient irrigation systems (leaky canals, over watering of fields with flood irrigation, etc.) often provide water for wetlands adjacent to canals and fields. These “islands” of habitat are often utilized by wildlife species, but disappear as old systems are replaced by more efficient newer systems.

Limited flow may also result from an agreement or mitigation measure whereby some designated flow must be allowed to remain in a stream channel. These flows guarantee that water will be left in a stream channel to provide a certain amount of aquatic community habitat. Water for flows were generally not owned by DWR, but were the result of agreements between the DWR and entities which controlled the water. In some cases, the water users furthest down stream protected fish habitat just because the water had to flow down the channel to reach them. However, in many cases, the furthest downstream user was at the end of a canal or ditch, which did not help the stream channel below the diversion.

“Conservation pools” (C-pools) are quantities of water, acquired by the DWR, in some reservoirs for the purposes of sustaining fish populations. Circumstances may also exist whereby stored water is released downstream, from a reservoir, when de-watering of the stream channel would occur under regular dam operations. Most C-pools were generally developed or purchased prior to 1983 (Fig. 1). Fish habitat in reservoirs were sometimes protected when dams had to be rebuilt or when the reservoirs were no longer used for irrigation. These stabilized reservoirs provide year round fish habitat, and their relatively constant level permits the growth of shoreline vegetation, which is important habitat for food organisms. More

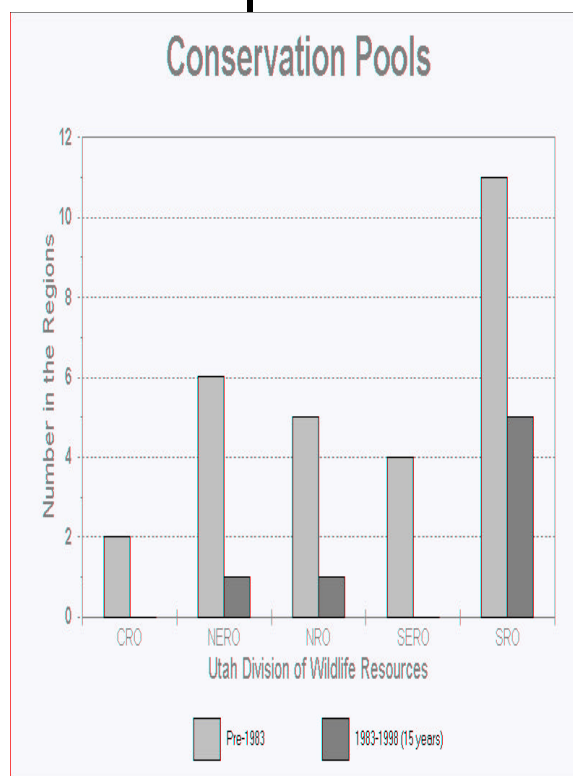


Figure 2. numbers of conservation pools by region

*continued*  
**Water and Water Use**

lakes were stabilized prior to 1983, than in the 15 years between 1983 to 1998 (Figure 2).

***Current Water Use***

Water continues to be a very valuable resource and commodity, even though the economy has become more industry/technology based. Agriculture has declined to the extent that water companies are concerned about preserving beneficial uses of water which was formerly applied to crops, and which land has now been developed into subdivisions. The state engineer has recently declared moratoriums on new filings for water in several basins because of increasing urbanization's demand on water. Recent ordinances in some cities require developers to provide water rights to the city before development can begin. This moratorium and mandatory water transfer has resulted in a higher demand (and prices) for water by municipalities, industry, water brokers and developers, making water purchases very expensive. Federal and state sponsored water projects are being constructed for water conservation and for more efficient use of water. Stabilization of high mountain lakes and acquisitions of conservation pools by DWR has decreased in the last 15 years, compared to the period prior to 1983. This is due in part to reduced DWR budgets and increasing prices for water. However, other agencies have been able to stabilize lakes or negotiate for conservation pools as mitigation in water development projects.

Purchase of water for instream flows or C-pools is expensive. As such, the DWR tries to partner with others for purchases when the opportunity arises to do so. Agreements for some limited flow between various government agencies, municipalities, and irrigation companies and water districts have been developed and entered into for the purpose of allowing water to remain in streams below their facilities, thus preserving some fish and riparian habitat along stream courses. Depending on the project, these agreements may be permanent or short-term, are for varying amounts of flow and season, and the water is not in the name of DWR.

Instream Flow Rights owned by DWR include: Manning Meadow Creek below Manning Meadow Reservoir and in Cottonwood and Ferron Creeks and San Rafael River. The CUP Completion Act (1992) has designated instream flows in three reaches of the Provo River and the first of the instream flows, between Jordanelle Dam and Deer Creek Reservoir, was implemented in 1996. The Utah Reclamation Mitigation and Conservation Commission, in conjunction with the US Bureau of Reclamation (BOR), has been stabilizing high elevation irrigation reservoirs on several projects.

The 1992 CUPCA legislation also initiated the Water Conservation Credit Program, whereby the private sector, municipalities, and Department of Natural Resources could receive 65% subsidies on approved conservation or water efficiency projects and may donate a portion of saved water for fish/wildlife benefits. The Natural

Resource and Conservation Service also recently initiated a cooperative program benefitting fish and wildlife.

In 1996, a Wildlife Habitat Authorization fee was initiated by the State Legislature to generate monies to enhance, acquire, preserve, protect, and manage fish and wildlife habitat in Utah. In 1997, funds were expended for acquisition of water rights in a lake and providing winter instream flows. However, much more needs to be done in the future.

#### ***Future Water Use***

The population of Utah is projected to grow from 2 million people in 1996 to over 3 million by the year 2015. As the state's population grows, the demand for water will also grow, and usually, greater priority is placed on water needs for humans, than for fish and wildlife. The agriculture demand for water will decrease, but urbanization, municipal and industrial demands for water will continue to increase. The demand for Utah's water comes not only from within the state, but also from neighboring states wanting to acquire Colorado River water or groundwater supplies from the West Desert. The foresight of DWR personnel to acquire water (and lands) for fish and wildlife benefits and habitat protection in the past should be commended, and should continue.

In the future, the Division will need to protect and make best use of its water and actively pursue and protect water for fish, wildlife and habitat. It is important that DWR water interests are sufficiently protected by timely filing of proper forms required by the state engineer. A central database for statewide minimum or instream flow agreements, C-pools and stabilized lakes will be useful for identifying protected resources and other needs. Basin wide fishery water management plans will be useful in prioritizing acquisition targets for waters on DWR lands and in streams, lakes, and reservoirs.

Solutions to problems should be investigated, especially from the aspect of partnering resources with others, to achieve win-win situations for all parties involved. (DWR should look for opportunities to partner with water users, land owners, municipalities and other agencies and programs to develop projects which would mutually benefit fish, wildlife and their habitats, as well as the cooperators). Opportunities for leveraging Wildlife Habitat Authorization monies for protection of fish and wildlife in high priority habitats should be actively pursued.

## Environmental Regulation

### *Who Oversees Environmental Regulation in Utah?*

Numerous state agencies have a role in planning for resource development in Utah. Within the Department of Natural Resources (DNR) there are seven Divisions which serve in this capacity. Forestry, Fire & State Lands manages the state forestry and fire protection programs, administers sovereign lands, and oversees mineral leasing on all state-owned, non-trust lands. Oil, Gas & Mining regulates exploration for and development of Utah's oil, gas, coal and other mineral resources. Parks & Recreation is responsible for protecting, preserving and managing many of Utah's natural and cultural resources located on lands under their jurisdiction. Water Resources coordinates with other divisions within DNR and other state and federal authorities on water planning, conservation and development. Water Rights oversees administration of Utah's water laws, stream alteration activities, and dam safety issues. Wildlife Resources (DWR) regulates hunting, fishing and trapping, and promotes recreational, scientific, and aesthetic enjoyment of wildlife. Utah Geological Survey investigates Utah's geologic resources, identifies geologic hazards, maps the state's geology and provides technical assistance to local government and state agencies.

Many of Utah's natural resources, however, are managed or regulated by state agencies which are located outside of the DNR umbrella. Perhaps the best known of these is the Utah Department of Environmental Quality (DEQ) which, along with its member divisions, serves a variety of environmental functions (regulatory, monitoring, liaison with federal agencies, etc.). The Utah Department of Agriculture oversees multiple programs that influence the well-being of Utah's privately-owned agricultural lands. School and Institutional Trust Lands Administration manages the state's school trust lands to maximize monetary returns for the benefit of Utah's primary and secondary schools and institutions of higher education. The Governor's Office of Planning and Budget directs Utah's wetland program. In general, many of the state agencies operating within this realm incorporate programs designed to:

- 1) promote the development of natural resources, and
- 2) protect and/or regulate those same resources from overdevelopment.

It is probably safe to say that, depending on the philosophy of the individual agency, one program can often tend to receive more emphasis than the other.

Various federal agencies, including the Bureau of Land Management (BLM), US Forest Service (USFS), and National Park Service, also manage vast tracts of Utah's landscape, and their collective responsibilities and authorities regarding natural resource management are immense. The Natural Resources Conservation Service also provides assistance to private land owners to manage their natural resources. The US Fish & Wildlife Service holds substantial acreage as wildlife refuges in Utah and has statutory

responsibility to manage migratory birds as well as threatened and endangered wildlife and plants. The Environmental Protection Agency has responsibilities regarding clean air and water, which extends to wetland protection. The US Army Corps of Engineers has responsibility to regulate dredge and fill activities in wetlands. The Bureau of Reclamation, a water development agency, also controls lands managed primarily for fish and wildlife habitat. A substantial portion of Utah is managed by the Department of Defense. These lands primarily serve as military training areas, but are also managed for their value as fish and wildlife habitat.

As a rule, states have traditionally held ownership of fish and wildlife within their respective borders. The various federal, or other non-state, agencies generally manage the fish and wildlife habitats located on their lands, but, with few exceptions, have no direct management jurisdiction over the animals themselves. The only exception to this is Indian reservations or trust lands. Due to their unique legal status, the several Indian tribes which exist in Utah own the wildlife within their respective trust land boundaries and oversee their own fish and wildlife management programs.

### ***Regulatory Authority of States***

In general, individual states are required to institute the minimum environmental standards as described under the various federal environmental laws. Perhaps the most familiar of these regulations are the Clean Air Act and the Clean Water Act. States may institute standards more stringent than the federal law requires if they so choose. Under some sort of agreement vehicle, administration of certain regulatory responsibilities normally reserved to the federal agencies may be delegated to the states. The federal agency in question generally retains some degree of oversight on states' programs and may elect to retain direct regulatory authority should it be determined that an individual state is not satisfactorily administering a program appropriately.

### ***The Case in Utah***

For the most part, the State of Utah has not chosen to take a particularly assertive role in the establishment of environmental standards, but has rather accepted those minimum standards as determined in federal legislation. There have also been instances where individual agencies have received regulatory authority of certain federal programs from the federal government. For example, the Utah Division of Water Rights currently administers the stream alteration permitting program (Section 404 of the Clean Water Act), normally under the auspices of the US Army Corps of Engineers.

### ***Role of the DWR in Environmental Regulation***

Currently, the DWR holds no regulatory authority and is not directly responsible for the administration of any federally mandated environmental standard. The Wildlife Code and various internal administrative rules, such as the Use of Division Lands (R657), do state in a general sense that activities which are deemed detrimen-

*continued*  
**Environmental Regulation**

tal to wildlife can be prohibited, but the scope of this authority is relatively limited. Under most circumstances, actual prosecutions for environmental violations, even when damages to wildlife are demonstrated, are the jurisdictions of other state and/or federal agencies, such as DEQ or the Environmental Protection Agency. The DWR can and does assess the impacts (in terms of numbers of fish killed, for example, in the case of a toxic spill) and can press a violator for direct restitution. If the direct impact to wildlife is deemed significant, and sometimes even if it is not or tenuous at best, the DWR has received fine monies for use in projects designed to benefit wildlife or their habitats.

Perhaps the most effective method that the DWR uses to influence the environmental regulatory process is what is broadly known as impact analysis. In recent years the agencies which administer various environmental programs, both state and federal, have generally shown an increasing awareness of their responsibilities to the renewable resources of the state. (Whether this reflects an expanding institutional environmental ethic or merely the result of external social pressures is debatable.) Nonetheless, the DWR is often invited to participate in some of the more practical applications of other agencies' administrative mandates.

On the federal level, the DWR is invited to critically review and provide comments to the myriad of documents which describe the environmental impacts of agency actions. These documents range from a one-page notification of a minor road realignment to a major Environmental Impact Statement describing a resource development proposal (such as oil and gas drilling, a large timber sale, etc.) or perhaps a comprehensive agency planning document (such as a BLM Resource Management Plan or a USFS Forest Plan) and everything in between. On the state level, similar sorts of projects are offered by the respective agencies for review. The DWR is also invited to provide input when other agencies are developing or modifying regulations or policies which may affect wildlife. For example, the Division of Water Rights solicited DWR's input when selecting the type of regulatory stipulations to apply to recreational gold dredging in streams.

The degree to which formal communications are required varies according to the level of review consultation. For example, at the initial notification or "scoping" level, the DWR is authorized to directly contact the respective agency and provide a list of potential impacts and/or analysis needs associated with a particular project. Once the final environmental analysis is completed on the project and the review process is near the end, any comments the DWR wishes to provide on the project must be submitted through the Resource Development Coordinating Council (RDCC), situated in the Governor's Office of Planning and Budget. RDCC compiles DWR's comments with those provided by other state agencies and issues a single response letter to assure that state government is seen to speak "in one voice." Critics may suggest that this procedure serves to somehow "water down" the DWR's comments

regarding a particular project. However, experience has shown that rarely, if ever, happens.

Mitigation can be defined as remedial actions imposed on a developer which serve to ameliorate the adverse impacts of a project to wildlife. These measures include:

- 1) avoidance of actions which would result in adverse impact
- 2) minimizing impacts by limiting the magnitude of an action
- 3) rectifying the impact by restoring the affected environment
- 4) reducing the impact over time
- 5) compensating for the impact by providing substitute resources.

DWR policy, which closely mirrors federal language on the topic, provides guidelines to assist in the application of the mitigation program and assessment of appropriate mitigative measures. Contrary to public perceptions, however, the reality is the DWR has little or no authority to mandate that adverse wildlife impacts be mitigated, particularly in instances where an impact occurs on federal lands (the most common situation). That authority usually rests with the federal land management or appropriate regulatory agency. The DWR may suggest mitigative measures and act as the conscience of the federal decision-maker. If the final decision is one that, in the DWR's opinion, is impossible to live with, the only recourse is to appeal that decision using the procedures available to it as just another member of the general public. The DWR's position is much stronger when development is proposed on lands which are owned by DWR. Commonly, these lands were purchased with federal funds specifically for wildlife benefit, and, as a condition of that federal participation, must be managed in a manner which does not compromise that objective. Consequently, proposed projects are scrutinized closely and, unless adverse impacts can be satisfactorily mitigated, can be rejected outright.

### ***The Next 15 Years***

It should be recognized that, for the most part, environmental standards have been delineated based on the adverse impacts of a substance or action on human health or activities. While wildlife impacts have not been ignored; they generally have been ancillary to alleviating undesirable effects on the human condition.

The DWR is not likely to become more of a regulatory player than it is already. The business of the DWR is wildlife, and it would clearly be beyond the current mission (or any anticipated modification of that mission) to expand its regulatory sphere of influence into that area. The DWR is considered to be a singular issue agency, and the odds of it attaining any kind of regulatory parity with the other established agencies is slim-to-none. The DWR will most likely continue to exert what influence it can to modify regulations and promote mitigative stipulations to benefit wildlife. That influence is probably more powerful than realized and, in most cases, has provided a good rate of return, in the form of wildlife and habitat benefits, for DWR efforts.



## Land Ownership

### ***Character and Land Implications of Land Ownership in Utah***

Land ownership in Utah is dominated by lands administered by the federal government, with acreage exceeding 35.7 million acres. The majority of federal lands are administered by the U S Forest Service and the Bureau of Land Management (BLM), both multiple use agencies. From a wildlife standpoint, federal ownership is advantageous for habitat protection and public access. Within federal ownership categories there are other designations that are important because they have their own inherent implications on the degree of protections such as, Areas of Critical Concern, Wilderness, National Parks, and Wildlife Refuges.

*Table 1. Utah Land Ownership, 1999*

Ownership	Acres	Percentage
Bureau of Land Management (BLM)		
(incl. Grand Staircase Escalante N.M.)	22,668,45	441.73
Private	11,659,652	21.46
Forest Service (USFS)	7,210,891	15.3
State of Utah (School & Institutional Trust Lands)	3,503,459	6.45
Native American Reservation	2,393,956	4.41
Military Reservation	1,834,387	3.38
Intermittent Water Bodies	1,545,611	2.85
National Recreation Areas	1,126,144	2.07
National Parks, Monuments, & Historic Sites	900,815	1.66
USFS & BLM Designated Wilderness Areas	765,233	1.41
State of Utah (Division of Wildlife Resources)	413,150	0.76
Water Bodies	129,053	0.24
State of Utah (Division of Parks & Recreation)	73,387	0.14
USFWS (mostly National Wildlife Refuges)	62,033	0.11
Bankhead Jones	29,774	0.05
State of Utah (Sovereign Lands)	5,450	0.01
<b>TOTAL</b>	<b>54,321,448</b>	<b>100.00</b>

Private ownership is the next largest category, comprising about 22%. These lands are extremely important because of the ownership pattern. Private lands were selected through the Homestead Act because of their productivity and proximity to water, and are the lower to mid-elevation (foothill, valley, stream corridor) lands which are extremely valuable to wildlife for winter habitat and riparian purposes. Lands that are privately owned and contain wildlife habitat, or those that are important for access to hunting and fishing areas, are the most at-risk to loss. Landowners make most of their decisions without regard to wildlife and their habitats. Consequently, habitat is frequently lost by displacement or fragmentation, or access to streams, lakes, hunting areas, and sometimes to adjacent public lands by sportsmen is denied. Privately-owned lands, with big game winter habitat values and cultivated crops

often have severe competition between livestock and wildlife for available forage and space. These attributes frequently translate into reduction of wildlife herd size or expensive mitigative measures such as damage payments or purchase of fencing materials for the DWR.

School and Institutional Trust Lands comprise 6% of the total land base or 3.7 million acres. Almost all these lands are located in rural Utah and have some habitat and access value for native and game species. While most of the lands are scattered in almost 5,000 parcels, usually in 640 acre sections, there are several major land blocks that are very important to the sporting public. These land blocks include the Book Cliffs, Tabby Mountain, Franklin Basin, Parker Mountain, and the Lasal Mountains, among others.

Utah's sovereign lands are those lands that underlie water bodies that were determined to be navigable at statehood and are owned by the state and managed for the public interests. The lands are comprised, primarily, of the beds of Great Salt Lake, Bear Lake, Utah Lake, and some stretches of the Green, Colorado Bear and Jordan Rivers. In addition, state sovereign lands include 816 miles of riverbed shoreline, and 792 miles of lake shoreline, on Great Salt Lake, Utah Lake, and Bear Lake. These waters provide 1,608 miles of shoreline and associated riparian and wetland habitats that are invaluable to the public. Additionally, the wildlife values associated with these lands (habitat and access) are fairly secure because of the Public Trust Doctrine which governs their management.

The Division of Wildlife Resources owns and manages approximately 413,000 acres. While this is a very small portion of the state, it includes some of the most critical wetlands, big game winter range, and other important wildlife lands in the state including the best Great Salt Lake marshes, significant acreage of critical winter range in the highest priority deer and elk herd units, and access to important streams. These lands are important for their habitat values and access for hunting, fishing, and wildlife watching.

### ***Ownership Trends***

The acreage of federal ownership has not changed much in recent years and probably won't in the future. What has changed is the designation of some federal lands for purposes that have wildlife implications (e.g., Escalante- Grand Staircase National Monument). In addition, there is a bill in congress that would designate millions more acres of BLM managed land as wilderness. While most arguments center around the amount of acreage to be designated, DWR's primary concern is the stipulated activities which would be allowed within the wilderness area. The Forest Service Wilderness Bill, passed in the mid-1970s, recognized the states' authority to manage wildlife that generally allowed the DWR to continue to utilize traditional wildlife management techniques. The International Association of Fish and Wildlife Agencies has a long-standing agreement with the US Forest Service and Bureau of Land Management that also helps guide this issue.

Also, Congress also recently passed a bill that expanded the boundaries of Arches National Park. National park formation and expansion usually eliminates hunting and restricts fishing opportunity.

Future decisions with regard to private lands are very important for wildlife. Utah is one of the fastest growing states in the Union. It is also one of the most urbanized. With 80% of the state's population living on the Wasatch Front from Brigham City to Nephi, the remainder occupy private lands in rural Utah, largely on agricultural holdings. The two largest impacts that may occur in the future is expansion of the human population in rural areas, and the breakdown of size and change of use of agricultural lands. Agricultural

*continued*  
**Land Ownership**

lands are important to wildlife for their critical range and habitat values and as large areas of open space for wildlife. All indications are that many of these larger acreages will be used for habitation by humans, and will be divided into smaller ownerships because of changing agricultural and associated social trends.

School and Institutional Trust Lands should remain an important component of wildlife habitat and will have increasing importance to the recreational public. While some minimal acreage may be converted to developed uses, the majority should remain in wild-land status.

The state's Sovereign Lands should remain available for wildlife use, however wildlife in turn will have to compete with other high priority public uses of those lands. No other public uses are foreseen that would override wildlife importance. The competition for use of such lands may be between "consumptive" and "non-consumptive" users.

***Conclusions***

Land ownership patterns and the implied uses are very important to wildlife and to the full range of wildlife enthusiasts who like to view, hunt, trap, or fish for wildlife. The predominance of public ownership of land enhances access and insures some level of habitat preservation. The agricultural trends and social aspects associated with them indicate that those large, open spaces that make up our agricultural lands in Utah will continue to erode in size and lose many of their attributes that are important to wildlife. Utah is one of the fastest growing states and as a result planning for the future of its citizens and wildlife will be very challenging.

Two important factors could significantly impact wildlife in a positive way on lands in private ownership. First is specific legislation enacted to manage growth and land management policies.

Recently, the Administration's Open Space Initiative has proposed to set objectives for maintaining open space and wildlife habitat, primarily through the maintenance of farmland and agricultural holdings. Recent state legislation, entitled the Quality Growth Act of 1999 (HB 119, Rep. Garn-sponsor), established a quality growth commission with certain duties and powers, including the reestablishment of the LeRay McAllister Critical Land Conservation Fund while providing for its administration and funding; expressed legislative intent on quality growth areas; allowed part of future increases in the private activity bond volume cap to be used for certain purposes; and appropriated \$250,000 from the general fund for technical assistance for local entities. Second, conservation easements provide an opportunity to affect private land ownership in a way that does not diminish the traditionally held private land ethic. Using conservation easements, DWR can accomplish the same objectives as past conversion of private land to DWR ownership, and in a much more socially and politically palatable way.

Access is a means whereby the public is provided the opportunity to physically reach areas (including streams and lakes) where wildlife is available for harvest, observation, photography or other uses. Throughout this discussion the term wildlife means all wildlife including fish and other aquatic species.

For the wildlife user, having access to wildlife is as important as having wildlife. One cannot hunt, fish, photograph, observe or otherwise interact with wildlife without access to the habitat where the wildlife population lives. It is true that wildlife has a very high intrinsic value that is not dependent upon use, but for the person who wishes to interact with wildlife, access is necessary. Many users prefer that access be convenient and inexpensive but access, even when it is somewhat limited, is valuable. Wildlife users and managers may be concerned with too much access as well as a lack of public access to wildlife. Management of populations can become difficult and the quality of habitat and wildlife related experiences can be compromised by uncontrolled access to wildlife. In fact access management is an increasingly important component of regulating wildlife use.

Under Utah law (23-20-14) a person, while hunting or fishing or while engaged in wildlife related activities may not enter onto properly posted private land without the permission of the owner or person in charge, must immediately leave private property when requested, and may not obstruct any gate or entrance. Land is considered properly posted if "No Trespassing" signs or a minimum of 100 square inches of bright yellow or fluorescent paint is displayed at all corners, fishing streams crossing the property lines, roads, gates, and right-of-ways entering the land. If a person is convicted of trespassing while hunting or fishing, that person may have their license, permit, tag etc. for that activity revoked. Upon a second such conviction a person may have their hunting or fishing opportunity revoked for up to five years.

Wildlife users in Utah have a great advantage when compared to wildlife users in other states due to the large amount of land in the state that is in public ownership. Public lands are generally open to the public for access to wildlife. Particularly in southern Utah, the majority of land (over 80% in several counties, see table 1) is in public ownership. However, it is also a fact, that private land in Utah is concentrated in the urban areas of northern Utah in the counties where the majority of Utah's citizens and wildlife users live. Davis, Morgan, Salt Lake, and Weber Counties are all over 80% private land. Box Elder, Cache, Rich and Summit Counties are the only other counties with over 50% private land. Access to wildlife is not directly proportional to public land ownership for two reasons: private lands are generally more productive lands that provide more habitat per acre than public lands and private lands are often strategically located in valleys, at the mouths of canyons, where there is water and in other advantageous locations resulting in access problems even in areas that are predominately public.

## Public Access

*continued*  
**Public Access**

Data on the amount of private land that is not posted is difficult to obtain but trends are obvious. Where the majority of non-cultivated private land was not posted 30 years ago, the great majority is now physically posted to control trespass. Many mountain and foothill areas that were once entirely open to hunters and anglers and, in fact were thought by many people to be public land, are now clearly posted as private land.

Public access to wildlife varies considerably by wildlife class. Big game, waterfowl, upland species (except pheasants) and nongame species are generally more accessible to the public than aquatic species. The fact that water is such a limited resource in Utah influences access to wildlife in several important ways. Many species of wildlife are found only in water or in water created environments such as marshes and riparian areas. Virtually all wildlife require some degree of access to water. Most agricultural activities are also water dependent. Thus wildlife, particularly aquatic and riparian species, and private lands tends to overlap to a large degree.

Utah's water laws and water use practices do not provide for public access. Current interpretation of law is that adjacent private landowners own the beds of streams and can thereby control public access to streams in the state. For many years and with varying degrees of success, the Division has worked with individual landowners along several Utah streams to provide for public access for fishing. This effort has been especially significant along the Weber River.

Public lands in Utah generally provide good access to big game. Access to big game is somewhat limited in northern and central Utah during late fall, winter, and early spring when most populations move onto private lands which provide winter range. There are a number of areas in the state where public access to big game and other wildlife on public lands is limited or blocked by private lands that are closed to public access. Big game winter ranges (around 300,000 acres) owned by the Division also provide public access to big game except during winter months when access is restricted to protect wintering populations. Public access to big game was a secondary benefit when the big game winter range program began and some ranges were purchased without adequate public access. Due to changing circumstances, the public access provided by big game ranges is now a major value to public ownership of these areas. The Big Game Cooperative Wildlife Management Unit Program (CWMU) provides hunter access to some of Utah's premier privately owned big game areas.

Native upland game species are generally accessible on public lands in most areas of the state. Upland game access problems revolve around ring-necked pheasants which are restricted to agricultural and adjacent areas which are almost all privately owned. Problems of public access to hunt pheasants resulted in the state's Posted Pheasant Hunting Unit program which was initiated in the 1930s and continues today. The Posted Pheasant Unit Program is

unique to Utah and has provided hunter access to pheasants at minimal cost for over 50 years. The posted unit program also provided the model for development of the big game CWMU.

Public access to waterfowl marshes adjacent to the Great Salt Lake was recognized as a need in the early 1900s. Public Shooting Grounds, on the north shore of the Great Salt Lake and acquired in the 1920s, was the first area in the United States purchased and developed specifically to provide public access for waterfowl hunting. Since that time, public access has been a fundamental part of the Division's waterfowl management program. The Division currently owns and operates 21 waterfowl areas encompassing approximately 92,000 acres of land. A very important guarantee of public access to the marshes adjacent to the Great Salt Lake is provided in the Utah Code which specifically sets aside thousands of acres of land to be managed by the Division for wildlife purposes and provides public access to state lands for fishing and hunting (Utah Code 23: 21- 4 and 5). Recent court rulings and changes in Utah law that created the State Institutional Trust Land Administration (SITLA) have changed the traditional access situation on school trust lands (sections 2, 16, 32, and 36 of each township).

The hunting and fishing public is no longer guaranteed access to these lands. Due to this change, the Division has recently negotiated an agreement with SITLA to provide hunting, fishing and trapping access to school trust lands. The agreement requires the Division to pay \$200,000 annually for access.

Excluding waterfowl management areas, winter ranges, and the pheasant PHU programs which all started decades ago, the Utah Division of Wildlife Resources has not had a program designed to provide access for wildlife users until the inception of the Habitat Authorization Program.

The Habitat Authorization legislation provides a specific legislative mandate, authorization and funding for a defined access program. Though, at present, the Division lacks any plan which defines goals, objectives, needs etc. People who travel around the west take note of the many, often large and conspicuous, signs found in other states notifying passers-by of public access areas. At this time, the

*Table 1. Percent of land in private ownership in Utah, by county*

Counties with at least 80% private land	
Davis	
Morgan	
Salt Lake	
Weber	
Counties with 50-79% private land	
Box Elder	
Cache	
Rich	
Summit	
Counties with 20-49% private land	
Carbon	
Duchesne	
Iron	
Sanpete	
Tooele	
Utah	
Wasatch	
Washington	
Counties with less than 20% private land	
Beaver *	Millard
Daggett	Piute
Emery *	San Juan
Garfield *	Sevier
Grand	Uintah
Juab*	Wayne *
Kane*	
* Less than 10% private lands	

*continued*  
**Public Access**

Division does not generally advertise public access points even when they are available.

Several trends and situations are combining to make access an increasingly important issue that will have a great influence on wildlife and wildlife users in Utah. If population projections are correct, we can expect human populations to continue to increase along the Wasatch Front and in adjoining counties to the east and in eastern Tooele County. At the same time, the monetary value of access to wildlife can be expected to increase, especially for access to fishing streams. Technology is also allowing a considerable number of families and individuals to live in the "country" and run their business from home. Many of these individuals are relatively affluent and place a high value on privacy. These "country" homes and developments are increasingly common throughout rural Utah and they often influence public access. Increases in human populations and the resulting urbanization complicate access issues and often lead to access restrictions on both private and public lands. In these situations, access restrictions may result due to resource damage, crowding, vandalism, trash, and lack of public awareness. In other cases, changes in land use eliminate or severely restrict wildlife numbers to the point that access to wildlife is restricted by the lack of wildlife.

"Today's information technologies have really only achieved the relative cost/reliability/utility of a 1930s automobile" (Edwards and Snyder, 1999). As such, the information technology revolution has passed the first third of the way (i.e., 25 years) through its projected duration. The second phase of the information technology revolution is now underway with a third phase yet to occur. Generally, regardless of the technology, the three phases of its being assimilated into institutions take 70-80 years, according to economic historians. The first phase encounters difficulties with high costs and inability for productive application, rendering the national economic impact as virtually nil. The middle phase sees the technology mature with reduced costs, increased reliability, and enhanced user friendliness. As well, individuals and organizations are better able to apply the new technology in limited local venues, yet with significant productivity outcomes. The final phase starts when the technology's price becomes relatively inexpensive, it is broadly applicable, easy to use, and has a structural framework which can be adapted to serve needs.

### ***The Present***

The average cost of the personal computer fell 15 percent per year from 1990-1996; in 1997 the drop was 22%, and in 1998 the average price per computer sold in the U. S. had fallen 32% by October 30th. Yet the reliability issue, as well as user friendliness for new learners have yet to be sufficiently addressed in order to fully integrate this technology into society.

### ***The Future***

Breakthroughs coming are voice recognition and speech replication, as well as personalized programmable machines. Beyond that, computerization of many other mechanical/electronic items will become more commonplace, including cell phones, microwaves, automobiles, and VCRs. These enhancements will enable us to send/give instructions, receive answers, explanations, even advice. As well, these machines will be networked allowing us to talk with them from afar, and for them to "talk" with each other based on our commands. The wireless telephone will be standard issue for people within 20 years, enabling people to communicate with others as well as their machines.

The Internet's successor, the Very-High-Performance Backbone Network Service (V-BNS), now being beta-tested at universities and government research centers, has 10 times the current Internet capacity. It is designed to integrate streams of data from multiple sources at the same time, and also enables real-time, 3-D audio and video transmission. This system will purportedly be ready for public consumption within a few years of the turn of the century.

"Network computing" will emerge in the next decade due to the tremendous personal advantages available from owning a PC/client/server, where users are able to access it via a variety of "personal digit appliances" (PDAs). The pocket-sized devices will combine several features together, including a cell phone, pager, Palm-Pilot, fax machine, and Internet terminal - plus a bar-

## **Technology**



*continued*  
**Technology**

code reader, optical scanner, and a digital video camera. By 2005, PDAs are anticipated to outsell PCs and start to displace PCs in the workplace. In most homes, however, newer PC versions will also serve as a telephone and a television.

## **Introduction**

In this section, information is presented about Utah's human population, including social and economic trends, and comparisons are made to the U.S. as a whole. Most of this information is from the book *Utah in the 1990s* (Heaton et al., 1996).

## **Human Population**

Utah has experienced rapid population growth in the past 25 years. Between 1970 and 1996, Utah's population doubled to 2 million people, making Utah the third fastest growing state in the U.S. Contrary to popular opinion, 3/4 of this growth has been due to natural increase (births exceeding deaths) while 1/4 has been from net migration. The high rate of natural increase is the result of a much higher than average birth rate and a lower than average death rate. The high birth rate results from both a larger family size and more child-bearing women in Utah's population. Most migration to and from Utah involves other states in the region, dominated by California. Net migration is a result of the condition of Utah's economy compared to other western states.

Although growth has occurred throughout the past 25 years, the rate has not been constant. During the 1970s, population increased by 38%, driven by a strong economy. The growth was 2/3 from natural increase and 1/3 from in-migration. During the economic downturn of the 1980s, population growth dropped to 17% and was entirely due to natural increase while net migration was actually negative. During the 1990s, the growth rate has increased to a projected 25% for the decade. With a booming economy, nearly 40% of this growth is resulting from net migration.

Utah is the tenth least densely populated state in the U.S., but also the 6th least rural. Land ownership, topography and the arid climate cause the population to be concentrated on a small percentage of the land. The four counties along the Wasatch Front account for 75% of the population (Salt Lake 42%, Utah 15%, Davis 11% and Weber 9%), which has not changed in the last 25 years. Regional changes in population are most obvious in the less populated counties. In the 1970s, growth occurred in the coal and oil producing counties. With the decline in these industries, growth stopped or reversed in these counties in the 1980s. In the 1990s, although still dominated by the Wasatch Front, growth is spreading to adjacent counties as well as Washington County. This pattern is expected to continue into the future.

Projections of Utah's population are for growth to continue and shortly after 2010 (less than 15 years) the population will pass 3 million residents, most living near or where the majority of residents already live.

## **Age Structure**

The age structure of Utah's population is a result of the high rate of natural increase. Utah has the lowest median age in the nation and the difference from the national average is increasing. Utah also

# **Demographics**

*continued*  
**Demographics**

has the largest concentration of its population in younger age groups (school and preschool ages). Finally, residents also have a longer life-span than the U.S. population. In the short term, the high fertility rate will continue this pattern but in the long-term the longer lifespan will increase the number of older residents.

***Families with Children***

A high percentage of Utahns are married compared to the remainder of the U.S. As a result, only 12% of Utah children belong to a single parent family compared to 20% for the U.S. However, Utah's rate is increasing, though still less than for the U.S. Surprisingly, Utah's divorce rate is higher than the national average but is offset by the high marriage rate. Utah children living outside of a traditional two-parent family will continue to grow.

***Racial and Ethnic Groups***

Utah has a unique ethnic and racial make-up, dominated by non-Hispanic whites, but the trend is towards a more ethnically diverse population. Minorities accounted for only 9% of Utah's population in 1990, compared to 25% for the U.S. The major minorities in Utah are American Hispanic (4.9%), Asian American (1.9%), Native American (1.4%), and African American (0.7%). African Americans are the most under-represented minority group in Utah, making-up 12% of the U.S. population. Native Americans are the fastest growing minority over the last 40 years, increasing from 2,700 in 1950 to 24,300 in 1990. Except for Native Americans in San Juan County, minority populations are concentrated in urban areas. Projections are that non-Hispanic whites, which are currently 75% of the U.S. population, will drop to less than 50% of the U.S. population by 2050. Although not as dramatic, Utah will also be seeing an increasing diversification of its population.

***Education***

Twenty-five percent of Utah's population is in school-age categories compared to 17% nationally. From 1980-1990, Kindergarten through 8th grade and high school enrollment in Utah increased 30 and 31 percent, respectively, compared to 8 and -14 percent nationally. Not only are more Utahns in school but a large number complete school. Utah ranks 2nd nationally in the percent of students completing high school, with 85% completing school compared to 75% in the U.S. Only Alaska has a higher completion rate. The picture changes for higher education. The percent of Utah students completing college and obtaining a degree is near the national average.

***Economics***

Utah has a strong economy but not all trends are positive. National comparisons with Utah must be interpreted in view of large child component of the population. Utah is ranked 21st in the nation in median income, a drop from the 17th position since 1979. Not only has the drop been in rank but the real median income has also dropped since 1979. The percent of Utah's population living in poverty is below the national average but growing faster than the in

the U.S. as a whole. Per capita expenditure for Utah is only about 85% of the national average, primarily due to a low per capita income and a large average household size. More women with children work outside the home in Utah than the national average. However, polls indicate Utah residents are more optimistic about the economy than the nation, a reversal from 20 years ago.

***Conclusion***

Utah's population grows faster, is younger, lives longer, has larger families, and is more urban than the US average. Utah will continue to grow at a rapid rate with the high birth rate driving natural increase and a strong economy generating a positive net migration.

## Wildlife Users

Human use of wildlife is responsible for shaping Utah wildlife policy and management through time. Utah was founded on an agrarian society intrinsically attached to renewable resources, including wildlife. Implicit in the first territorial law, January 13, 1853 pertaining to fish and wildlife is the protection of fish from overuse. Subsequently, the user has occupied a prominent role in all facets

of wildlife management, including socio-economic, political, quality of life, and many other societal concerns.

*Table 1. Participants (U.S. residents, age 16 and up) in hunting, fishing, and wildlife-watching in Utah, 1991 and 1996*

Activity	Total in Utah	Residents in Utah	Nonresidents in Utah
<b>1991</b>			
Hunting	177,000	158,000	19,000
Fishing	317,000	226,000	91,000
Wildlife-watching: On a trip	415,000	245,000	170,000
Near home	463,000	463,000	
<b>Total</b>		736,000	
<b>1996</b>			
Hunting	143,000	113,000	30,000
Fishing	406,000	265,000	141,000
Wildlife-watching: On a trip	433,000	202,000	231,000
Near home	380,000	380,000	
<b>Total</b>		558,000	

Important to this document is a definition of a wildlife user. For this purpose a wildlife user is: a person who dedicates specific time and/or resources toward the recreational use of wildlife. This document will focus on who wildlife users are, how they have changed through time and the probability of who they will be in the future.

### Wildlife Users

Based on the definition of a wildlife user, three elements are important to consider when evaluating use. They are: time, resources, and recreation. There was a period in territorial history when a fine line existed between recreation, subsistence, or economic wildlife use. Mountain

men trapped to supply a European fur economy and, along with early immigrants, hunted to provide protein for the table. It is apparent however, to any student of these periods, that recreation also played an important role in their otherwise commodity driven initiatives. Aspects of the recreational experience other than harvest are obviously important for nonconsumptive wildlife users, but research has shown these same factors are important for hunters and anglers (Hendee 1972).

*Table 2. Days of participation (U.S. residents, age 16 and up) in hunting, fishing, and wildlife-watching in, 1991 and 1996*

Activity	Total in Utah	Residents in Utah	Nonresidents in Utah
<b>1991</b>			
Hunting	1,354,000	1,294,000	60,000
Fishing	2,539,000	1,930,000	609,000
Wildlife-watching: On a trip	2,985,000	2,002,000	983,000
<b>Total</b>	6,878,000	5,226,000	1,652,000
<b>1996</b>			
Hunting	1,660,000	1,445,000	205,000
Fishing	3,926,000	2,843,000	1,083,000
Wildlife-watching: On a trip	2,802,000	1,384,000	1,417,000
<b>Total</b>	8,388,000	5,672,000	2,705,000

The elements of time and resources (materials) are the expendable commodities of the wildlife user. How willing the user is to apply them depends on numerous factors including wildlife availability, opportunity, desire, wildlife resource richness (quantity and quali-

ty), competition for time and resources, past experiences and others.

The 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation indicates that 40% of the U.S. population, sixteen years old and older, enjoyed some type of wildlife-related recreation. Twenty percent hunted and/or fished and an additional 31% engaged in nonconsumptive activities. Nonconsumptive activities included observing, feeding and photographing wildlife. (The sum of anglers, hunters and nonconsumptive participation exceeds the total number because many individuals engaged in more than one wildlife related activity.)

The same survey revealed that the percent of Utah residents engaged in wildlife-related activities is similar to the national percentages. Forty percent (558,000) of Utah residents engaged in fishing, hunting or wildlife-watching activities in 1996 (Table 1). Of the total number of participants, 24% (331,000) fished and/or hunted and 30% (415,000) participated in nonconsumptive activities. As mentioned above, the sum of anglers, hunters and nonconsumptive participation exceeds the total number because many individuals engaged in more than one wildlife related activity.

By activity, 113,000 residents hunted, 265,000 fished and 415,000 participated in wildlife-watching activities (Table 1). In addition to the residents, a large number of nonresidents participated in wildlife recreation in Utah. The number of nonresidents taking trips to watch wildlife actually exceeded the residents in 1996. Not only do a lot of people participate in wildlife recreation but they also commit many days to it. Residents spent nearly 5.7 million days hunting, fishing, or wildlife watching in Utah in 1996 (Table 2).

Finally, Utah residents also participate in wildlife recreation in other states. In 1996, Utah residents spent over 900,000 days at wildlife recreation in other states (Table 3).

### **Characteristics of Wildlife Users**

In the U.S., 92% of hunters are male, 8% female (USFWS). The participation rate of hunters decreases as age increases (USFWS). Hunting is more popular among rural individuals than urban individuals. Among hunter education course graduates from 40 states, 92% were raised in the country, small towns or small cities (Jackson 1992). The mandatory hunter education program in Utah has consistently trained ten to twelve thousand students per year

*Table 3. Days of participation (U.S. residents, age 16 and up) by Utah residents in hunting, fishing, and wildlife-watching in other states, 1991 and 1996*

Activity	1991 by Utah Residents Outside of Utah	1996 by Utah Residents Outside of Utah
Hunting	108,000	109,000
Fishing	506,000	415,000
Wildlife-watching: On a trip	571,000	402,000
<b>Total</b>	<b>1,186,991</b>	<b>927,996</b>

*continued*  
**Wildlife Users**

through time but the state population has increased significantly through the same period.

Demographically, anglers differ from hunters in several ways. In the U.S. in 1991, 28% of men and 10% of women, 16 years old and older fished. Within the angler population, 72% were male and 28% female and the largest percentage were in the 25-44 year group representing 52% of all anglers (USFWS 1993). Fishing has more participation by urban dwellers (45% of the nation's anglers come from urban areas). Youth have a significant interest in fishing among both urban and suburban environments. A nationwide study of children and wildlife revealed that 72%, 72%, and 80% of urban, suburban and rural children, respectively reported an interest in fishing (Westervelt and Llewellyn 1985).

Major findings from three years of study (Duda, Bissell and Young 1995) concerning factors related to hunting and fishing in the U.S. include:

- *Participation in hunting as a percentage of the U.S. population has remained stable between 1980 and 1991.*
- *Hunting among American males is decreasing while hunting participation among American females is increasing.*
- *For males, the largest effect on hunting participation is associated with growing up in rural areas. Age is the second biggest influence.*
- *Social changes are responsible for the increased participation in hunting among females.*
- *Fishing among American males has remained stable while fishing participation among females is increasing.*
- *The largest determinant of lack of male participation in fishing in the U.S. are increasing age and fewer men growing up in rural areas.*

Wildlife viewing is not a new activity in Utah but is one that is coalescing into a primary activity, as it is nationally. These wildlife users come from all age, race, gender, and economic backgrounds. Likelihood of participation does increase as level of education and income increase. A difference from hunters and fisherman is the likelihood of women to participate in equal numbers to men.

***Changes in Wildlife Use***

Looking at the five year national trend from 1991 to 1996, the number of individuals fishing and/or hunting held steady and the number of nonconsumptive participants decreased by 17%. However, since 1985, the number of Utah resident hunters has decreased by 40% while the number of resident and nonresident anglers increased by 28% and 55%, respectively. There was a decline of 17% in wildlife watching participants from 1991-1996 but between 1980 and 1990 a 63% increase in adults taking wildlife trips to watch, feed, or photograph wildlife occurred.

Although Utah lost resident adult hunters from 1991-1996, the total days of hunting increased and the average days hunting per hunter increased significantly from 8 in 1991 to 12 in 1996. This increase in the last five years has probably less to do with the same people hunting more in the last five years, and more to do with the loss of incidental hunters who only hunted one weekend a year for deer. The cap on deer permits and the deer population decline following the severe winter of 1992-93 likely affected the incidental hunter.

Changes in wildlife use seem to follow in part trends in land use, demographics, wildlife user opportunity, and emerging societal values. Utah started as an agricultural economy. Agriculture, including farming and ranching, are still paramount in many parts of the state, but in most cases the agricultural industries have changed dramatically. Changes from small family farms to farming and ranching corporations have also influenced wildlife populations and subsequently users. The number of farms decreased starting in the 1930s from over 30,000 to 11,000 in 1980, but the average farm size increased from 300 to over 1,050 acres during the same period (Greer 1981). Other land use changes have influenced user opportunity. These include urbanization, especially along the Wasatch front, Cache and Washington Counties and a more holistic approach to land products, including wildlife, which has fostered programs, such as the Posted Hunting Units, that have augmented landowner income. The development of large community centers and associated bedroom communities and the move away from farm life to industrial and technological occupations have changed the interests of people. Denser and more populated areas foster competing recreation opportunities impacting traditional and non-traditional wildlife uses.

In many cases wildlife users are shifting away from traditional to emerging wildlife opportunities. Bison roundups, Bald Eagle Day, birding excursions, and visiting nature centers are emerging as the thing to do. Privatization of wildlife or at least working toward optimizing income from wildlife through posted hunting units, private game preserves, and ecotourism seem to be emerging trends. Wildlife based educational TV programming is influencing how some Utahns are perceiving wildlife and its use.

### ***The Wildlife Users in the Year 2013***

In 15 years the user will be shaped largely by external factors. Place of residence, access to wildlife habitats, cost in relation to benefit, and satisfaction are some important external factors that will affect the degree of interest and desire to participate in wildlife recreation. Almost every study of traditional wildlife use indicates that most hunters and many anglers come from a rural or near rural setting. Between 1950-1980 many male hunters may have worked in metropolitan areas but they came from a rural setting. This may not be true of the 25-45 year old hunters in the year 2013 who are the offspring of parents who moved from the farm but established urban residences. Trends indicate that hunting for big game is stable now but will diminish through time. Access is an increasing



*continued*  
**Wildlife Users**

issue with traditional wildlife users as will be the cost of the consumptive experience. Present, and likely future, conditions will require a premium payment for a premium wildlife experience on private land. The Cooperative Wildlife Management Program or its evolutionary progeny will only handle small numbers of low cost public clients. There will be an increased hunter focus to hunt on public land. Access to Wildlife Management Areas (WMA) will increase exponentially through time by all users. There will be increased demands for these areas by non traditional users. Stream fisherman will pay more for access or switch to public flat water fisheries. Users will be forced to make hard decisions on costs for use. Many users will be dissuaded from participating due to cost. For those that continue to participate, benefits will need to match their interest to pay (satisfaction). These users will either sacrifice for these opportunities or will pay without sacrifice. The trend will be toward wealthier users for unique or quality resources on private land. Satisfaction will play an ever increasing role for users. There are and will be competing forms of recreation for user time, e.g., professional sports teams, golf, and other urban recreational activities will continue to erode wildlife users' time. These activities are more compatible with an urbanizing society.

In conclusion, the future user will tend away from hunting sports especially those tied to private land. Fishing and wildlife viewing will tend to increase, especially on public access areas. As we urbanize, the user will tend toward protection and away from conservation.

### ***Introduction***

The purpose of this section is three fold. First, the opinions of American citizens toward hunting and fishing are summarized from a recent national survey (Duda, 1995). Second, public attitudes and opinions towards wildlife taken from the surveys in the mid-1970s and in 1986 in Utah are summarized (Rawley, 1974-6; Krannich and Cundy, 1987). Third, a summary of the most recent Utah statewide survey is presented (Krannich and Teel, 1998). This study was conducted in the winter of 1998 and captures both resident Utahns' and DWR constituent opinions regarding wildlife management, resource conditions and wildlife-associated recreation.

Key data summarized from these public opinion surveys include: overall image of the Division, support for wildlife management programs, funding sources for management programs, and specific wildlife-related issues.

### ***National Public Opinion Toward Hunting and Fishing***

Results from a national survey to determine "Factors Related to Hunting and Fishing Participation in the United States."

A survey of 2085 adults, selected at random, resulted in the following opinions about hunting and fishing.

**Public Opinion on Hunting** - Almost three quarters of all adult Americans (73%) approved of legal hunting. Eighty-one percent of these same individuals believe hunting should remain legal. Although a strong majority of these individuals support hunting in general, the level of support varies based on the expressed reason for hunting. For example, most Americans support hunting for food and recreation but opposition increases when hunting is for a trophy.

Most hunters hunt for the sport/recreation or for meat. The percent of hunters hunting for meat is decreasing while the percent of hunters hunting to be close to nature is increasing. Reflective of the 1986 Utah resident study, this survey indicates other Americans also derive satisfaction from being close to nature, camaraderie, special equipment, exercising, bagging game and planning and remembering the hunt.

Finally, some of the most important values surrounding hunting are those centered on the family. The value of hunting as a traditional family activity or as a way of furthering social bonds was a major feature of the study.

**Public Opinion on Fishing** - Almost all Americans support legal fishing. Ninety-five percent of all Americans surveyed approved of fishing. An overwhelming number of those surveyed (96%) believe fishing should remain legal.

## **Public Attitudes/Opinions**

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**Public Attitudes / Opinions**

The survey discovered that the most important values surrounding fishing, as they are with hunting, are naturalistic and those values center on the family. A major benefit of fishing is having undivided time and attention with their children.

Overall, American hunters and anglers are satisfied with their hunting and fishing experiences and with state fish and wildlife efforts to provide these opportunities.

***Survey Results from the Mid-1970s and 1986***

Utah residents gave the Division an overall performance rating of "good" during the mid-1970s. Public scoring for this rating ranged between 59-64 based on the following scale: Excellent = 100, good = 67, fair = 33, and poor = 0. The 1986 survey continued to rate performance as "good", with a score of 70 based on a similar scale. Younger residents, females, and non-license buyers tended to rate the Division higher than license buyers or those more active with wildlife. It is also interesting to note that in 1986 about 74% of the public had an interest in wildlife, and expressed a desire to see improvements or increases in populations of big game, small game/waterfowl, fisheries and nongame wildlife.

Utah residents in the mid-1970s generally considered employees of the Division to be courteous, professional and helpful when contacting the public. Public scoring was about 1.6 based on the following ranking: -2 = low, 0 = neutral, and +2 = high. This question was not repeated in the 1986 survey.

Regarding the Division's management of wildlife, Utah residents in the mid-1970s liked the following: overall policies and regulations, fisheries programs, and hunting programs to a lesser degree. When the reciprocal question of what the public did not like with the Division's management, the following were noted: some policies (no specific group), hunting programs, and law enforcement/poaching to a limited extent. Similarly, the 1986 survey indicated that the Division management programs most liked were general policies and fisheries (particularly those related to hatchery production and stocking). In contrast, however, the 1986 survey indicated a shift in the public dislike of the following Division management programs: licence and permit fees, dissatisfaction with public access to wildlife on private lands, and inadequate law enforcement of poaching. In both opinion surveys, 50% or more of the respondents had no comment regarding the most- or least-liked Division management programs. A more definitive question was also asked in the 1986 survey on programs the public wanted either to continue or drop. Key management programs for continuance were: Increase fish stocking and overall fish populations, increase big game populations other than deer and elk, and increase restrictions on regulations relating to fishing and hunting (particularly for big game). Key management programs for discontinuance were: trout stamp purchase, year-round fishing (implemented the year prior), and antlerless big game hunts (mainly deer and elk).

Utah residents supported the continued use of hunting and fishing licenses as the main funding source for Division management programs in the mid-1970s. About 52% of those sampled could support the use of either state budgets (general fund) or excise taxes on related selling of recreational equipment (hunting/fishing/trapping) as a funding supplement to license sales. The 1986 survey indicated continued funding support of Division programs through license sales, but did not want to see increases in license costs or new wildlife-related taxes.

Moderate support existed to enhance funds using state general tax revenues and assignment to the Division of 1/8th of a percent from existing sales taxes. Strong funding support for the Division was identified from the sale of conservation type stamps, state income tax refund check-offs for all wildlife, and a possible mitigation tax on industries which damage wildlife and their habitats.

About 91% of Utah residents in the mid-1970s felt that present levels of wildlife habitat should be maintained. However, the majority did not know or understand exactly what steps should be taken to maintain existing habitat. Because industrialization and economic development can impact wildlife habitat, a question of emphasis between maintaining habitat and economic development was asked. About 27% felt the state overemphasized economic development, 37% felt it was okay, and 27% felt economic development was under emphasized. The 1986 survey was more detailed in its identification of public opinion towards competing or incompatible activities and wildlife resources preservation. Strong public support existed for restricting housing and highway development if wildlife or their habitats were reduced. Moderate support was indicated towards limiting oil, gas and coal production if fish and wildlife populations were reduced. Though supportive, a more neutral stance was taken by the public towards maintaining livestock grazing and reservoir/dam construction as it may impact wildlife populations and habitat.

No elements to determine public satisfaction as it relates to wildlife-related recreation were determined in the mid-1970s surveys. Elements of satisfaction were identified in the 1986 survey for hunting, fishing, and wildlife observation. A significant number of participants in wildlife-related recreation identified the following factors as being a satisfactory experience: seeing wildlife, being out-of-doors with nature, and getting away from everyday problems and/or civilization. Harvesting game or catching fish seemed to be of secondary importance compared to the overall experience of being out-of-doors with wildlife.

### ***1998 Survey Results -- Executive Summary***

This summarizes key findings from a 1998 survey of Utah residents and resident hunting and fishing license purchasers regarding their attitudes and opinions about the quality and importance of Utah's wildlife resources, and about the management of those resources. The study was conducted for the Utah Division of

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**Public Attitudes / Opinions**

Wildlife Resources by the Institute for Social Science Research on Natural Resources at Utah State University, under the direction of Dr. Richard S. Krannich, Professor of Sociology and Forest Resources at USU.

The findings presented in the report are based on data obtained through telephone interviews conducted between early March and early June, 1998 with 1,401 Utah residents from throughout the state. Random samples were drawn to represent the state's adult (individuals age 18 or older) population as a whole, and also to represent individuals who had purchased resident hunting or fishing licenses in the prior year. Both the general public and license purchaser samples were drawn using a disproportionate stratified sampling procedure designed to insure representation of residents and license buyers in both metropolitan and nonmetropolitan areas of the state. This approach provided a basis both for profiling the perspectives of Utahns at large and for evaluating possible differences in the attitudes and preferences of residents who live in various parts of the state and who exhibit differing patterns of participation in wildlife-related recreational activities. For the general public sample a total of 1,332 eligible respondents were contacted and 901 interviews completed, representing a 68% response rate. For the license purchaser sample a total of 623 eligible license purchasers were contacted and 500 interviews were completed, representing a 80% response rate.

Because the range of issues addressed in the survey is vast, any attempt to summarize the results in only a few pages must necessarily remain incomplete. However, several of the key findings derived from the survey are highlighted below; more complete detail on these and other findings appears in the body of the final project report.

- Overall, Utahns exhibit high interest in the state's wildlife resources. Interest levels are fairly high among the general populations of both metropolitan and nonmetropolitan areas, and especially high among hunting and fishing license purchasers. On a scale ranging from 0 ("no interest whatsoever") to 10 ("more interest than anything else"), the mean response value for the statewide general public sample was 6.4, indicating moderately high levels of interest. Among hunting and fishing license purchasers the overall mean response value was 7.6, indicating high overall interest in Utah's wildlife resources.
- Although the Division of Wildlife Resources has actively pursued public input regarding wildlife management issues by encouraging citizen participation in the Regional Wildlife Advisory Council (RAC) process, relatively few Utahns are aware of this process, and even fewer report that they have participated in it. Results from the statewide general public sample indicate that only 18% of adult Utahns have ever heard of the RAC process. Only about 14% of those who said they were aware of the program had actually attended a RAC meeting. About 27% of resident hunting and fishing license purchasers have heard of the RAC program, with 31% of those who were familiar with it indicating that they had attended at least one RAC meeting. These results suggest that input obtained via the RAC programs is unlikely to fully represent the perspectives of most Utahns with interest in the state's wildlife.

- Most Utahns believe that the costs of supporting wildlife management activities in the state should be borne by a relatively broad cross-section of the state's residents. When asked to consider who should assume responsibility for providing funding to support efforts to protect and enhance populations of both game species and non-game species, respondents overwhelmingly indicated that funding should be provided by either "all Utahns with an interest in wildlife" or "all Utah residents." While slightly over one-half of the public at large and about two-thirds of license buyers are aware that at present it is hunting and fishing license buyers who provide most of the funding for wildlife management in the state, a substantial proportion of Utahns apparently remain unaware that the costs of wildlife management are not more broadly distributed across the state population as a whole.
- Overall, Utahns are moderately satisfied with the way that wildlife and fish resources are currently being managed by Utah's Division of Wildlife Resources. On a scale ranging from 0 ("completely dissatisfied") to 10 ("completely satisfied"), the mean response for both the statewide general public sample and the sample of license purchasers was 5.4, slightly above the scale midpoint.
- A series of eight questions asked respondents to evaluate the Division of Wildlife Resources in terms of the agency's effectiveness in providing various wildlife-related programs and opportunities. The individual questions focused on provision of wildlife observation opportunities, fishing opportunities, hunting opportunities, enforcement of laws to protect wildlife, provision of public information and education programs, protection and improvement of wildlife habitat, protection of nongame species, and protection of game species. For all of these items responses were measured on a scale with values ranging from 0 ("not at all effective") to 10 ("extremely effective"). In general, both the general public and license purchasers evaluated the DWR as being at least moderately effective in addressing these program areas. For example, the mean responses to a question addressing the effectiveness of DWR in protecting and improving wildlife habitat were 6.1 for the statewide public at large and 6.3 for all license purchasers. The item that received the lowest effectiveness rating focused on efforts to provide information and education programs to help Utahns understand and support wildlife conservation efforts; mean scores were 5.5 for the general public sample and 5.9 for license purchasers. The item that generated the highest effectiveness rating involved provision of opportunities for people to fish and catch fish, with mean responses of 7.0 and 7.1 for the general public and license buyers, respectively.
- Consistent with their interest in wildlife, Utahns exhibit very high levels of support overall for actions and programs that help to protect and enhance wildlife and wildlife habitat. Both the general public respondents and license purchasers expressed strong agreement that access to some public land areas should be restricted during certain periods in order to protect wildlife. Utahns also expressed strong agreement that energy resource extraction and the development of housing and roads should be limited in areas where such activities may threaten wildlife or destroy important wildlife habitat. In addition, they strongly favor restrictions on certain types of recreational activity such as the use of off-road vehicles and jet skis in areas where such activities may negatively affect wildlife or fish populations. For example, one of the questions in this series asked whether the respondents agreed or disagreed that the use of off-road vehicles should not be allowed where such activities would threaten wildlife or damage wildlife habitat. On a response scale ranging from 0 ("disagree very strongly") to 10 ("agree very strongly"), the mean response value was 7.8 among the general

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public and 7.5 among hunting and fishing license purchasers.

- Utahns are highly supportive overall of DWR programs involving the acquisition of land and water resources to protect and enhance wildlife habitat and to increase public access for recreational uses. While respondents expressed some ambivalence about efforts to acquire lands within urban areas or in areas immediately surrounding urban centers, they are extremely enthusiastic about acquisition efforts that would focus on land areas providing key deer and elk habitat, water rights that would protect fish populations during dry periods, riparian habitat areas, and areas providing public hunting access. For example, respondents were asked to indicate how much priority DWR should place on acquiring land areas needed to maintain or increase deer and elk populations. On a response scale ranging from 0 ("very low priority") to 10 ("very high priority") the mean response was 7.4 among the statewide general public and 7.9 among license purchasers. Similarly, the mean response values for a question asking how much priority should be placed on acquisition of water rights to protect fish populations during dry periods were 7.9 among the general public and 8.3 among license purchasers.
- Strong support for wildlife protection and for regulation of wildlife-related recreational activities is evident in responses to a series of questions pertaining to DWR law enforcement programs. Both members of the public at large and hunting and fishing license purchasers were particularly adamant in their beliefs that DWR should prioritize the enforcement of laws that require the purchase of a hunting or fishing license, that impose restrictions and limits on the taking of fish and game, prohibit loaded firearms in vehicles, prohibit driving under the influence of alcohol, restrict trespassing on private property, and that prohibit littering and pollution of the environment. For all of these questions the mean response values on a scale ranging from 0 ("very low priority") to 10 ("very high priority") were in a range between 7.4 and 9.0, indicating very high priority ratings. Slightly lower priority ratings were assigned to the enforcement of laws protecting endangered species and protecting nongame bird species, with mean response values for these items falling between 5.6 and 6.7.
- Substantial proportions of Utahns engage in nonconsumptive activities related to the state's wildlife. Over 40% of survey respondents reported that they feed wildlife, and nearly one-third said they maintain plantings intended to provide wildlife habitat. About four in ten Utahns report participation in wildlife observation outings, with hunting and fishing license purchasers substantially more likely than members of the general public to report participation in these types of outings. Levels of satisfaction with wildlife observation experiences (measured on a 0-10 scale) were quite high among both the public at large (mean response value of 6.9) and among license purchasers (mean response of 7.1).
- Most Utahns believe that DWR should place a moderate to very high priority on habitat protection and informational programs designed to enhance wildlife observation opportunities. For example, when asked to indicate how much priority should be placed on development of watchable wildlife sites or trails in urban areas, the mean response values (on a 0-10 scale) were 7.0 for the statewide general public sample and 6.7 among license purchasers. Similarly, mean responses to a question asking about the extent to which DWR should prioritize the presentation of radio and television programs to educate the public about Utah's fish and wildlife resources were 7.1 among members of the general public sample and 7.4 among license purchasers.
- Responses to questions pertaining to the management of big game populations reveal that Utah's hunters are only moderately satisfied with

their big game hunting experiences. On a scale ranging from 0 (indicating that hunting experiences were "extremely poor") to 10 (indicating that experiences were "extremely good"), the mean response among big game hunters was 5.65, only slightly above the scale midpoint. At the same time, Utah's big game hunters tend to be only moderately supportive of possible management changes, including some that could potentially enhance hunting quality. For example, only about one-third of respondents indicated that they would favor the implementation of a drawing-based approach to the allocation of general bull elk tags, and fewer than 30% were supportive of having a drawing for spike bull tags. Hunters also expressed little support for some alternative approaches to the management of deer hunting opportunities. For example, roughly equal numbers of hunters expressed strong approval and strong disapproval of a concept involving revised procedures for the sale of deer licenses so that members of traditional family hunting groups would be assured of getting licenses to hunt in the same area. Survey respondents were also ambivalent about the concept of offering a one-day, youth-only deer hunt, with nearly one-half of respondents indicating that they would disapprove of such a program.

- Upland game hunters express only moderate levels of satisfaction with the quality of their recent hunting experiences in Utah. On a 0-10 response scale, the mean satisfaction rating among upland game hunters was 5.3, barely exceeding the scale midpoint. Waterfowl hunters express substantially higher satisfaction, as reflected by a mean response score of 7.3. Upland game hunters are highly supportive of the concept of releasing pen-raised birds to increase the number of birds available during hunting seasons. Among both upland game and waterfowl hunters there is only limited support for the provision of a youth-only hunting date, but high support for the implementation of access restrictions to reduce crowding in high-use hunting areas.
- Over 50% of Utah adults indicate that they have purchased a fishing license at some time during the past three years. Among those who have never purchased a license or have done so only in the more distant past, the lack of time to fish emerged as the dominant reason for choosing not to participate in fishing. However, responses also indicated that access to information about fishing areas and techniques, concerns about the quality of fishing and crowding, and concerns about public access to fishing areas are also important factors that limit fishing participation and recruitment.
- Recreational cougar and bear hunting and management efforts to control predator species that prey on game populations emerged as perhaps the most contentious issues addressed in the survey. With regard to predator control as a means of protecting populations of game species, responses indicated a substantial split in opinion among Utahns at large, with substantial proportions of survey participants expressing both strong opposition and strong support for such management actions. Among the statewide general public the mean response value (on a 0-10 approval scale) for this type of management approach was just 4.9. License purchasers expressed slightly higher support, as indicated by a mean response value of approximately 6.0.
- Support for cougar and bear hunting was limited even among most hunting and fishing license purchasers, and extremely low among the general public. On a 0-10 scale the mean approval rating for recreational hunting of cougar was just 4.4 among the general public and 6.4 among license purchasers. More substantial opposition was evident regarding the use of hounds to hunt cougar, with mean scores of just 3.5 among the general public and 5.6 among license purchasers. With respect to recreational hunting of black bear, mean approval ratings



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were 4.4 and 5.7 among the general public and license purchasers, respectively. Use of hounds to hunt bear received substantially lower approval ratings, as evidenced by mean response values of just 2.9 among the public at large and 4.6 among license purchasers. Even less support was expressed for allowing bear hunters to use baits, with mean response values falling to just 2.3 among the general public and 3.7 among license purchasers.

In summary, results of the survey indicate that Utahns are highly interested in the state's fish and wildlife resources, and highly supportive of efforts to protect and enhance wildlife populations through law enforcement, habitat acquisition, limitation of land and resource developments, restrictions on access to and use of certain key habitat areas, and funding derived from a broad cross-section of the state's population. Clearly Utahns place substantial value on the state's wildlife resources, and view the protection and enhancement of those resources as important to the quality of life enjoyed by residents of the state.

The results also indicate that most Utahns are at least moderately satisfied with their wildlife-related recreational experiences, and with the ways that DWR is managing wildlife resources and providing for wildlife-related recreational opportunities. It is important to note that respondents generally did not indicate either substantial dissatisfaction with current conditions or substantial opposition to most management actions that DWR is now pursuing. In some ways the gap between high levels of interest in wildlife and more moderate levels of satisfaction with wildlife management may be inevitable. Constraints imposed by limited fish and wildlife populations and limited agency resources make it difficult, if not impossible, to provide the range and quality of wildlife-related recreational opportunities that many Utahns would like to experience. Utah's wildlife managers are confronted with a difficult task in their efforts to balance public demands for wildlife-related recreational opportunities with the need to protect and preserve the state's fish and wildlife resources. Hopefully the results presented in this report will provide wildlife managers and policy makers with useful guidance. Better knowledge about issues that Utahns wish to see prioritized with respect to wildlife management and key areas where additional dialogue and information dissemination are needed, should prove useful in the search for improved future management efforts.

## Wildlife Economics

### Introduction

Since 1955, a survey of U.S. residents has been conducted at five-year intervals, asking about their hunting, fishing and wildlife-related recreation. The reports from the survey provide information on participation and expenditures of U.S. residents 16 years of age or older. The most recent survey was completed for 1996 (USFWS 1997). Using data from the survey, the International Association of Fish and Wildlife Agencies commissioned studies of the economic contributions of hunting and fishing on the national and state levels which provide much of the detailed information provided below (Southwick Associates 1998, Maharaj and Carpenter 1998).

The wildlife recreation related dollars that move through the economy have a significant impact both nationally and on the economy of Utah.

Nationally, 40 million U.S. residents 16 years of age or older went hunting or fishing in 1996, and spent \$71.9 billion to do it (Table 1). In addition, 62.9 million Americans were wildlife-watchers in 1996 and spent \$29.2 billion to observe, feed or photograph wildlife. In Utah, the numbers are equally impressive.

*Table 1. Comparison of total expenditures (in 1996 dollars) for hunting, fishing and wildlife-watching in U.S. and Utah, 1991 and 1996*

Activity	United States		Utah	
	1991*	1996	1991	1996
Hunting	14,329,000,000	20,613,412,000	--	132,248,000
Fishing	27,589,000,000	37,797,061,000	--	231,292,000
Wildlife-watching	24,216,000,000	29,227,888,000	--	236,626,000
TOTAL	66,134,000,000	87,638,361,000	--	600,166,000

*\* 1991 figure has been adjusted for inflation and to account for items included in 1996.*

Economic impacts will be effected by Utah's growing human population, the general economic climate, the availability and accessibility of wildlife, and the general interest in consumptive and non-consumptive use of the wildlife resources.

### Expenditures

In 1996, 143,000 U.S. residents 16 years of age or older reported hunting in Utah. Of these, 30,000 were nonresidents. These hunters spent \$151,000,000 for goods and services in Utah which generated over \$300 million in economic output (Table 2). This economic output supports over 4,800 jobs in Utah with total wages of \$87 million. The retail sales generate \$8.3 million in sales tax and the economic output generates an estimated \$3.6 million in state income tax. Even with the cap on deer permits, deer hunting accounted for over \$63 million of hunters' expenditures.

Separate expenditure figures are not given for nonresidents who spent money in Utah, but nonresidents accounted for 12% (205,000 hunter days) of the total days spent hunting in Utah in 1996. Using the national average of \$80.00/day, this calculates to \$16,400,000 spent by nonresidents in Utah for hunting activities.

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**Wildlife Economics**

In 1996, 406,000 U.S. residents 16 years of age or older reported fishing in Utah. Of these, 141,000 were nonresidents. These anglers spent \$231,000,000 for goods and services in Utah which generated over \$460 million in economic output (Table 2). This economic output supports over 6,773 jobs in Utah with total wages of \$124 million. The retail sales generate \$11.2 million in sales tax and the economic output generates an estimated \$5.2 million in state income tax.

Nonresidents accounted for 1,083,000 fisherman days in Utah. At a national average of \$60.00/day spent including trip related expenses and equipment, nonresidents spent about \$64,980,000 here.

In 1996, 644,000 U.S. residents reported participating in wildlife

*Table 2. Economic Impacts for Hunting and Fishing in Utah, 1996*

	Retail Sales	Economic Output	Earnings	Jobs	Sales Tax	State Income Tax
Hunting	\$150,829,764	\$306,601,356	\$86,719,044	4831	\$8,313,187	\$3,583,553
Fishing	\$231,291,509	\$468,403,271	\$124,003,524	6773	\$11,275,261	\$5,193,480
Total	\$382,121,273	\$775,004,627	\$210,722,568	11,604	\$19,588,448	\$8,777,033

watching  
in Utah. Of  
these,  
433,000  
took a trip  
of at least  
one mile to

participate in wildlife watching and 380,000 watched wildlife within a mile of their home (some did both). Over one-half of the days of wildlife watching in Utah are by nonresidents. Although a detailed analysis of wildlife-watchers' economic contributions to Utah has not been completed, we do know from the survey that participants (residents and nonresidents) spent \$237 million to watch wildlife in Utah in 1996 (Table 3). This calculation of total expenditures for wildlife-watching is comparable although not as inclusive as the retail sales reported for hunting and fishing (Table 2).

Nonresidents accounted for 1,417,000 days of activity in Utah. This figure accounts for 51% of the total days spent watching wildlife here. Using the national average of \$82/day, nonresidents spent about \$116,194,000 in Utah during 1996 pursuing wildlife watching activities.

***Other wildlife related economic considerations***

Wildlife contributes to the quality of life in Utah. This contribution will have some impact on Utah's ability or tendency to attract and hold new businesses. Something must be said about the value of those impromptu contacts with wildlife that brighten the day and just make this a nice place to be and live. This contribution is very difficult to quantify.

Distribution of recreation dollars spent by residents within the state is probably influenced by the fact that many wildlife related dollars are spent in rural Utah rather than on other urban based recreational activities. This transfer of money can be very important to some rural businesses. The sale of cooperative wildlife management unit permits and landowner permits (both expanding programs) likely have an important economic impact locally. New money generated

by the sale of these permits and jobs created by the guiding operations most employ are examples. Other hunting and fishing guide operations may have a significant economic impact. The legal sale of harvested wildlife should also be considered and may have a very significant impact, as with the brine shrimp industry.

Some wildlife related recreational dollars would probably be spent in other states in pursuit of wildlife related activities by both residents and nonresidents if those activities, or significant populations of wildlife, were unavailable in Utah.

Wildlife has an economic cost, as well. The opportunity and monetary cost of managing and protecting threatened and endangered species may be locally significant. The costs of protection, usually associated with habitat, are fairly easily identified. The benefits of protection are again difficult to tabulate. Habitat protection issues typically are intertwined with open space and the harvest of other natural resources issues. The non-use of the resources or the ground and/or the benefits of providing open space without development or disturbance complicate the economics of threatened and endangered species management immensely. The economic impact of wildlife depredation in the livestock and agricultural industry should be considered although mitigation (payments, permits, etc.) must also be considered. Recent changes in the depredation laws provide some relief for affected owners and provide an economic incentive to maintain wildlife rather than removing it.

*Table 3. Expenditures for Wildlife-Watching in Utah, 1996*

Trip-related expenditures	\$ 125,477,000
Expenditures for Equipment	\$ 83,397,000
Expenditures for Other Items	\$ 27,752,000
Total Expenditures	\$ 236,626,000

### ***Future Trends in Wildlife Related Expenditures***

The economic implications of expenditures for wildlife related activities in Utah will depend on the availability of the wildlife and opportunity to use it. Economic contributions of hunting and fishing depend more upon the availability of a harvestable portion of the population or harvest regimes that discourage depletion of the harvestable portion of the population (catch and release, antler restrictions for example) while encouraging participation in the activities. Other management related decisions can have a significant impact on the level and distribution of these expenditures. Examples would be restricting the total number of hunters and redistributing the participation by establishing areas with different regulations.

Changing demographics could have a significant impact on the availability of wildlife for future Utahns. Changing public opinion with regard to hunting, fishing, funding for wildlife management, commercialization of wildlife and the importance of wildlife to the quality of human life could all influence the economic role of wildlife and wildlife management. Projections on these and other issues should be drawn from demographic projections.

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**Wildlife Economics**

Economic contributions of non-consumptive uses could benefit from promotion of an appreciation of the resource and non-consumptive activities. Comparisons to our neighboring states with regard to total non-consumptive use show an interesting potential.

The issue of who will pay for funding of wildlife management in the future may be key to the whole issue of wildlife related economics. If dwindling wildlife populations (for whatever reason), or changing social values or other factors diminish the consumptive users' ability or willingness to fund wildlife management, someone else will have to fill that niche. Some management is required to keep wildlife (particularly those species that depend heavily on management) abundant and available for consumptive and non-consumptive use. Some efforts are being made to share the cost of management (such as the Teaming With Wildlife/Outer Continental Shelf Initiative), and any wildlife/economic discussion should include such alternatives.

## Privatization of Wildlife

In a traditional and legal sense, wildlife in the United States of America has always been a public resource. Ownership and control of resident wildlife is one of the implied powers not specifically granted to the federal government in the U.S. Constitution.

Therefore, this authority devolves upon the various state governments. Similarly, ownership of wildlife has not been one of the "rights" associated with private property ownership. That is, ownership of land does not mean that one owns the wildlife which happens to be present. This system, which is different from the European model where private individuals do own wildlife, has been basic to the history of wildlife management in America. It has been instrumental in giving our society what is arguably the best and most equitable means for wildlife conservation and sharing in the entire world.

Beginning with statehood in 1896 and continuing until approximately the 1960s, Utah landowners were afforded few opportunities for owning or profiting from wildlife on private lands. Apart from the ability to control and thus to charge an access fee for wildlife related activities such as hunting or fishing, no special programs were available to landowners. Ownership and the ability to control utilization and harvest of wildlife remained the sole province of the state.

In recent years numerous programs, either administratively or legislatively created, have arisen which to some degree "blur" the line between private and strict public ownership of wildlife. Programs now allow the operation of private aviculture and aquaculture facilities where protected wildlife species can be held in captivity and sold to others. A relatively thriving market exists for live wildlife and wildlife parts. "Certificates of Registration" are available that allow protected furbearers such as bobcats to be held. "Commercial Hunting Areas" allow protected upland game species to be pen-reared and released for fee hunting purposes on private lands. "Posted Pheasant Hunting Units, which first came into being in the 1960s, have now evolved into Cooperative Wildlife Management Units (CWMU) and cover a wide variety of protected wildlife including most upland and big game species. Big game was added in 1991 as an experimental program. Now an established part of the program, big game offers landowners the ability to jointly control and manage big game on their land with the Division and the incentive to profit from that cooperative effort. Where land on a Limited Entry Hunting Unit fails to meet the criteria for a CWMU, special landowner big game permits are available to landowner associations that can be marketed. "Mitigation" vouchers are also available to individual landowners for antlerless permits and allow landowners to realize some revenue from having big game on their land to at least partially mitigate for crop losses or rangeland forage consumed by big game.

The most recent paradigm change occurred in early 1997 when the state legislature voted to allow "elk ranching" as an "alternative livestock operation". Moreover the authority to regulate this new

*continued*  
**Privatization of Wildlife**

industry was removed from the state's wildlife conservation agency and the responsibility given to the state Department of Agriculture. Aquaculture is similarly regulated. Proponents of elk ranching foresee an expanding business in selling elk antlers, elk breeding stock and possibly elk venison for human consumption in specialty restaurants.

The question now becomes: what does the future hold? If current trends continue the rate and scope of wildlife privatization will continue to increase. It may be only a matter of time before elk ranching is expanded to include other big game species. Commercial Hunting Areas (CHAs) will almost certainly increase in number and in the services offered. As habitat continues to shrink, CHAs will be the future of pheasant hunting in Utah. CWMUs are also becoming more popular and more numerous. If not already, our current system soon might legitimately be described as a hybrid between a European and traditional North American one. A decision is needed concerning what is the maximum or desirable level of privatization that can be allowed while still maintaining the principle of public ownership or trusteeship of wildlife.

An issue closely related to the ownership of wildlife and about which a great deal of public misconception exists is public responsibility or legal liability for the actions of wildlife on either public or private land. At present, a paradox exists in that while Utah and other states maintain ownership, state governments disavow any legal liability for the actions of wildlife. In the past, laws have usually been written with language stating that the state "may" pay for damages or "may" offer other forms of compensation. Civil lawsuits directed against states for damages purportedly caused by wildlife have always foundered on this principle. Language in recent laws, however, stating that the DWR "shall" take certain actions seem to imply a certain degree of liability. The question of liability or responsibility with respect to private owners is, I believe, equally unclear. If indeed the state does have a legal or financial liability, the question of whether that liability must be shared by all citizens or just those who pay license fees to hunt or fish must be answered.

## HISTORICAL REVIEW (1980s through present)

### ***Commercialization Statute***

The present statute (23-13-13) addressing the commercial use of wildlife has remained unchanged in the last 16 years. It reads: It shall be unlawful for any person to utilize wildlife as a commercial venture for financial gain except as provided in this code and under rules and regulations of the Wildlife Board.

Although in the last 16 years the state has in general prohibited the commercialization of wildlife for financial gain it has allowed limited commercialization in a number of important areas. The following sections review the history and present legal status of commercialization by category of wildlife (except for the last section which discusses guiding).

### ***Aquatic Wildlife***

*Historical review.* Utah Code prohibits the sale of protected aquatic wildlife (except as provided), and has remained essentially unchanged since 1980 (23-15-8). In 1980 a code change allowed the sale of protected aquatic wildlife from a private fish installation (23-15-11), but this was subsequently repealed. The 1982 seining and bait dealer rule allowed commercialization of salamanders, crayfish and other species as live bait. It also allowed the collection of brine shrimp and their eggs. In 1986 this rule became the commercial fishing regulations. CORs could be issued for live bait, dead bait, and commercial brine shrimp.

*Present status.* Utah Code prohibits the selling of protected aquatic wildlife except as provided (23-15-8). The Code permits a person to sell aquatic animals from an aquaculture or fee fishing facility as provided by Title 4, Chapter 37, Aquaculture Act (23-15-13). Rules governing aquaculture are now administered by the Department of Agriculture. The Administrative Rule permits the selling of harvested or seined nongame fish as specified, including salamanders, leeches, crayfish, brine shrimp/eggs, or overabundant nuisance game species (R657-14). The Administrative Rule permits the importation and subsequent commercialization of species designated as controlled (COR required) or non-controlled. However, commercialization of prohibited species may be permitted if a benefit is shown (R657-3).

### ***Reptiles and Amphibians***

*Historical review.* The 1982 Collection, Importation and Transportation (CIT) Proclamation allowed the commercialization of all captive live wildlife not listed as prohibited. The 1985 Amphibians and Reptile Proclamation prohibited taking of any reptile or amphibian in Utah for commercial use.

*Present status.* Administrative Rule only allows for the importation and subsequent commercialization of species designated as controlled (COR required) or non-controlled. The commercialization of any turtle less than 4" in carapace length is prohibited. However

## Commercial Use of Wildlife



*continued*  
**Commercial Use of  
Wildlife**

commercialization of prohibited species may be permitted if a benefit is shown (R657-3).

**Game Birds**

*Historical review.* The 1986 Commercial Hunting Area Proclamation allowed for a Commercial Hunting Area to be established on private land where artificially raised game birds are released and hunted for a fee.

*Present status.* Utah Code allows a person to operate a commercial hunting area for the purpose of shooting pen-raised game birds (23-17-6). Administrative Rule allows landowners to establish commercial hunting areas for game birds that are released for the purpose of allowing hunters to take the game birds for a fee (R657-21).

**Non-game Birds**

*Historical review.* The 1982 CIT Proclamation allowed the commercialization of captive live wildlife, if the species was not prohibited.

*Present status.* Administrative Rule allows for the importation and subsequent commercialization of species designated as controlled or non-controlled. The Division may allow the commercialization of prohibited species if a benefit can be shown (R657-3).

**Raptors**

*Historical review.* The 1984 Proclamation for Captive Breeding of Raptors allowed for the sale of captive bred raptors to general and master class falconers.

*Present status.* Administrative Rule permits falconers to purchase/sell captive bred raptors (R657-20).

**Migratory Game Birds**

*Historical review.* Federal regulations 20 years ago prohibited the purchase/sale of migratory birds or their parts.

*Present status.* Federal Regulations prohibit the sale/purchase of feathers of migratory birds and mounted specimens (50 CFR 20). Administrative Rule allows landowners to establish management units for waterfowl and sell permits which allows the permit holder to hunt waterfowl within the CWMU (R657-21).

**Non-game/Native Mammals**

*Historical review.* The 1982 CIT Proclamation allowed for the commercialization of all captive wildlife if not listed as prohibited.

*Present status.* Administrative Rule makes it illegal to purchase/sell any non-game mammal or its parts (R657-19). Administrative Rule allows for the commercial use of dead jackrabbits (R657-3).

**Furbearers**

*Historical review.* The 1985 Furbearer Proclamation allowed for registered fur dealers and for a licensed person to sell species that had been legally taken.

*Present status.* Administrative Rule allows a person with a valid furbearer license to sell legally taken furbearers, and a person with a furdealer COR to purchase/sell pelts (R657-11). Administrative Rule allows for the sale and propagation of bobcats, martin and lynx. Animals may not be taken from the wild for this purpose. It also allows for the commercial use of dead coyotes, muskrats and raccoons without a COR (R657-3).

### ***Bear and Cougar***

*Historical review.* In the mid 1980s the Cougar/Bear Proclamation prohibited the sale of any green pelt from a cougar or bear. There was no specific prohibition to selling cougar or bear teeth, claws, paws or skulls including bear gall bladders.

*Present status.* Administrative Rules permit the selling/purchasing of tanned cougar and bear hides. They prohibit the purchasing/selling or bartering of cougar or bear teeth, claws, paws and skulls. Additionally bear gall bladders may not be purchased/sold (R657-10 and R657-33).

### ***Small Game Mammals***

*Historical review.* The 1982 CIT Proclamation allowed commercialization of non-prohibited captive wildlife. No CWMUs were in existence for small game.

*Present status.* Administrative Rule allows landowners to establish management units for small game and sell permits (R657-21).

### ***Big Game***

*Historical review.* The 1986 Big Game Proclamation allowed only for the selling/purchasing of heads, hides, antlers and horns. This proclamation also stated that those species of big game or parts possessed or propagated under a valid Utah COR or are imported legally may be sold any time of year. No PHUs (CWMUs) for big game existed in the mid 1980s.

*Present status.* Administrative Rule prohibits selling of any big game or their parts except antlers, heads, hides and horns of legally taken big game. There are restrictions on when these may be sold (R657-5). Administrative Rule allows for the establishment of CWMUs and the sale of permits to generate income for the landowners (R657-37). Administrative Rule allows for the propagation and sale of caribou, fallow deer, muskox and reindeer by a person with a COR. Animals may not be taken from the wild for this purpose (R657-3). The Domesticated Elk Act allows for the possession and sale of domesticated elk and their products. Wild elk may not be used as a source (4-39-101).

*continued*  
**Commercial Use of  
Wildlife**

### **Guides**

*Historical review.* In the early 1980s a Guiding Proclamation existed and guides had to purchase a COR to participate in guiding activities. Shortly thereafter the DWR administration determined that it was inappropriate to regulate guiding activities since guiding was a business and the DWR should not play a role in business regulation. Guiding regulations were then abolished.

*Present status.* At present there are no guiding regulations. However in 1996, and again in 1997, the DWR did submit a guiding bill to the legislature for approval. The bill did not leave committee.

### **FUTURE PERSPECTIVE**

It is highly likely that in the immediate future (10-15 years) the commercial use of wildlife in Utah will increase significantly. Those potential areas of increase include:

- Aquaculture, including trout and catfish operations;
- Elk and other big game ranching;
- Sale and purchase of antlers;
- Demands for additional CWMUs;
- Guiding and outfitting activities;
- Demands for the establishment of private hunting areas for domesticated and exotic wildlife;
- Collection/propagation/sale of exotic and native birds and reptiles.

The Division will address any increased demands for commercial use of wildlife in an objective manner. We will promote a philosophy of carefully balancing the commercial activities that are perceived to benefit Utah economically with the potential impacts of these activities on the wildlife resource. Blanket opposition to commercialization activities is likely to be unproductive.

Some of the specific concerns/issues that must be addressed in the near future that are likely to result from increased commercialization demands include:

- Impacts resulting from the potential increased outbreak and spread of wildlife diseases including TB, brucellosis, Chronic Wasting Disease (CWD) and whirling disease;
- Impacts on wildlife users (both consumptive and non-consumptive) as a result of potentially less recreational opportunities resulting from increased commercialization;
- Impacts on the genetic integrity of all wildlife populations;
- Aesthetic concerns resulting from the commercialization of wildlife;

- The regulation of commercialization activities. What are the Division's best interests in this area? Should the regulation of these activities be surrendered to agriculture?
- Who will pay the cost of monitoring, evaluating and regulating commercial impacts?

# Acknowledgements

Internal/External Operational  
Environment Assessment Report

Utah Division of Wildlife Resources

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## ***Internal Items:***

Organizational structure  
Organizational history and culture  
Fiscal analysis/budgeting process  
Technology, facilities and equipment  
Habitat Fund  
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Depredation management

Greg Evans  
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## ***External Items:***

Wildlife populations  
Native wildlife  
Threatened and Endangered Species  
Big game  
Upland game  
Waterfowl  
Furbearers  
Sport fish  
Aquatic invertebrates  
Plants and plant communities  
Physiography and climate  
Wildlife habitat  
Natural resource development  
Water and water use  
Environmental regulation  
Land ownership  
Public access  
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Wildlife users  
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